

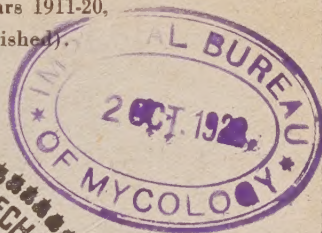
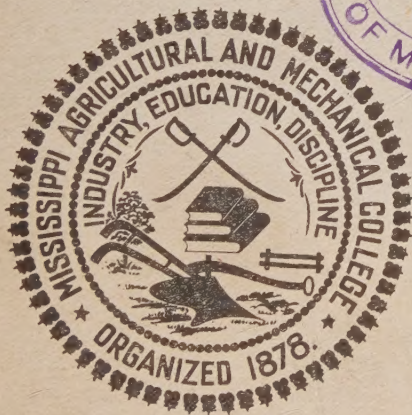
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

AGRICULTURAL AND MECHANICAL
COLLEGE OF MISSISSIPPI

THIRTY-FOURTH ANNUAL REPORT

FOR THE FISCAL YEAR ENDING
JUNE 30, 1921.

(Annual Reports For the Years 1911-20,
Inclusive, Were Not Published).



J. R. RICKS, Director.

Agricultural College, Mississippi.

STATION STAFF.

D. C. HULL, M. Sc.	President of College
J. R. RICKS, M. Sc.	Director
H. B. BROWN, Ph. D.	Plant Breeder, Vice-Director Chief in Agronomy
E. B. FERRIS, M. Sc.	Assistant Director, South Miss. Branch Station
C. T. AMES, B. Sc.	Assistant Director, Holly Springs Branch Station
G. B. WALKER, B. Sc.	Assistant Director, Delta Branch Station
C. B. ANDERS, B. Sc.	Assistant Director, Raymond Branch Station
S. W. GREENE, M. Sc.	In charge of Coastal Plains Branch Station*
W. F. HAND, M. Sc., Ph. D.	Chemist
J. S. MOORE, M. Sc.	Chief in Dairy Husbandry
R. W. HARNED, B. S. A.	Chief in Entomology
K. U. JONES, B. Sc., V. M. D.	Veterinarian
C. F. BRISCOE, A. M., Ph. D.	Bacteriologist
J. M. BEAL, M. Sc.	Botanist
E. P. CLAYTON	Poultry Husbandman
W. C. MORSE, M. Sc.	Geologist
E. BARNETT	Chief in Animal Husbandry
C. J. GOODELL, B. Sc.	Animal Husbandman
A. B. McKAY, B. Sc.	Chief in Horticulture
E. R. GROSS, B. Sc.	Chief in Agricultural Engineering
F. C. COTTRELL	Agricultural Engineering
J. C. C. PRICE, B. Sc.	Horticulturist
D. C. NEAL, B. Sc., M. A.	Plant Pathologist
.....	Dairyman
J. N. LIPSCOMB, M. Sc.	Farm Management
J. F. O'KELLY, B. Sc.	Agronomist
R. N. LOBDELL, M. Sc.	Entomologist
W. E. AYRES, M. Sc.	Plant Breeder, Delta Branch Station
H. F. WALLACE, B. Sc.	Assistant at Holly Springs Branch Station
F. B. RICHARDSON, B. Sc. ..	Horticulturist, South, Miss., Branch Station
M. E. ANDREWS, M. S. A.	Associate in Farm Management
F. H. HERZER, B. Sc.	Associate Dairyman
A. C. WALTHALL	Agricultural Editor
H. H. HARNED, M. S.	Assistant Bacteriologist
MISS KITTIE SUE JOHNSON, A. B.	Stenographer and Clerk
D. W. McILWAIN	Superintendent of Farm
B. V. EVANS	Farm Foreman, South Miss. Branch Station
J. C. RYAN	Farm Foreman, Holly Spring Branch Station
I. P. TROTTER, B. Sc.	Farm Foreman, Delta Branch Station
D. MAXWELL	Foreman, Horse and Beef Barns

*In Co-operation Bureau of Animal Industry, U. S. Department of Agriculture.

LETTER OF TRANSMITTAL.

To His Excellency, Lee M. Russell
Governor, and President of the Board of Trustees,
Jackson, Mississippi.

Sir:

In accordance with the provisions of Section No. 3 of the Act of Congress, approved March 2, 1887, "To Establish Agricultural Experiment Stations," etc., I have the honor to transmit the Thirty-Fourth Annual Report of the Director of the Mississippi Agricultural Experiment Stations for the Fiscal year ending June 30, 1921.

Very truly yours,

D. C. HULL,
President.



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Agricultural College, Mississippi,

June 30, 1921.

President D. C. Hull,
Agricultural College, Mississippi.

Dear Sir:

I have the honor to submit the following annual report of the Mississippi Experiment Station, for 1920-21.

The work at this, the Central Station, as well as at the Branch Stations, has been systemized and is being conducted on a more systematic basis than ever before. Every piece of experimental work at any of the stations must be carefully planned and an outline of the project submitted to this office. This outline, in turn, is referred to a committee on projects for criticism before final approval and before work can actually begin. We found this necessary because too often some one would begin work on some problem without giving sufficient thought to formulate a project of value and then after money had been spent the work would be dropped and no results reported. And too, when a member of the staff leaves the service, his successor often times wants to undertake a new line of projects and drop some that are not finished even though considerable money has been expended on them. By requiring approved projects and by requiring that these projects be kept active for a sufficient time to draw definite conclusions, we will get dependable results with the least expenditure of money.

The funds of the Central Station come from both the Federal and State Governments. From the Hatch and Adams Act, we receive a total of \$30,000 annually from the Federal Government. At the last session of the State Legislature an appropriation of \$27,300 for 1920, and \$19,300 for 1921 was made. This is the first state money ever appropriated for this Station and was for new work,—that is, for work which was not being done because of inadequacy of the funds we were receiving from the Government. The Branch Stations are supported entirely from State appropriations. During this annual period these stations have done better work than ever before because the funds made available by the last Legislature were sufficient to properly equip them and for the expenses of doing the work. From the time those stations were established until the beginning of the biennial period 1919-21, we have never received appropriations sufficient for the best work.

Detailed reports of the work in each department and at each of the branch stations are attached. I wish, however, to give a brief outline of the work which has been done and which is now under way.

AGRONOMY.

The Department of Agronomy has under way at the present time the following projects: Effects of Certain Crops on Soil Fertility, Forage Crops, The Use of Various Forms of Lime for Different Crops, Permanent Pastures, Temporary Pastures, Cultural Methods of Corn, Various Forms of Nitrogen for Corn and Cotton, Sulphur Fertilizers for Alfalfa, Phosphate Investigations, Crop Rotations, Different Crops for Silage, Boll Weevil Control, Cotton Wilt Test, Corn and Cotton Spacing, Variety Test with Corn, Cotton and Other Common Field Crops, and Cooperative Fertilizer Tests.

Valuable data was obtained on these lines of investigations. Bulletins and circulars have been published, giving results from the work with corn and cotton. Material for bulletins on fertilizer investigations is now ready for the printer.

The funds used for all projects in the Department of Agronomy are the Hatch and Federal Sales Fund. No State funds are available for this work. There are many new projects that we think should be undertaken in this department. The work here and at the Branch Stations with fertilizers is not enough to give the information needed for all soil types of the State. We need funds to carry on cooperative fertilizer and crop work in many counties where results from the Stations will not apply.

ANIMAL HUSBANDRY.

Experimental work in this department is carried on with four classes of farm animals, viz.: horses, beef cattle, sheep, and hogs.

Horses. The work in mule breeding is now being completed and in the near future we hope to publish the results. This is an Adams Fund project and has now been under way for twelve years. It has been the most expensive project ever undertaken, has required large numbers of animals and a long time for results.

Beef Cattle. For this work a small pure bred herd each, of three are used, viz.: Hereford, Angus, and Shorthorns. In addition to these a fair sized herd of grade cows of each of three breeds is maintained for breeding purposes. The work consists in grading up by the use of pure bred bulls on the various grades and comparing off-springs from each; the feeding of steers to compare the different feeds; and the cost of wintering and handling of the breeding herds. Enough data has been obtained on the feeding of steers for a good bulletin, which will be published in the near future. Also, some valuable data on the cost of wintering and the handling of the breeding herd has been obtained.

Sheep. For the past two years there has been some work done in grading up native sheep by the use of pure bred rams. On account of the limited pasture space it is impossible to do this work on a large enough scale to get the results that we would like. Some valuable data has been obtained and tabulated.

Hogs. This work includes grazing tests with different crops, different feeds, and methods of feeding and soft pork investigations. We have three years' results on these different projects, which are valuable, especially on soft pork, and which we expect to publish this year.

BACTERIOLOGICAL DEPARTMENT.

Dr. C. F. Briscoe has charge of the work in this department and the experiments carried on in this line are very important. This work is done as an Adams Fund project. Some of the more important projects are: the comparing of different green manure crops with forest leaves, limit to amount of green manure crops for profitable returns, accumulative effects of compost materials compared with alfalfa, and pounds of nitrogen contained in different crops from soils of different degrees of fertility. These are all long time, technical projects, and will require several years for completion.

ENTOMOLOGICAL DEPARTMENT.

The work in this department consists of systematic and biological study of the crawfish of Mississippi, the scale insects, and insects affecting pecans. The work has progressed satisfactory in all these projects. The crawfish project is one that has been under way for many years and much valuable data has been obtained. At present Mr. Lobdell, who has charge of this work, is trying out several control measures on some badly infested crawfish land in the Prairie Belt, near Muldon, Mississippi. This work is given in detail in Professor Harned's report, which is attached. It is hoped that enough data will be obtained on which to base recommendations for the control of this serious pest.

Progress has been made on the study of scale insects and insects injurious to pecans. There are several other projects in this department which should be taken up, but we have no funds for new work.

DAIRY DEPARTMENT.

The work in this department has been expanded since the last session of the Legislature. A small appropriation made this possible. Mr. Earle Brintnall was employed a little more than a year ago to do this work under the supervision of Professor J. S. Moore. Some excellent results have been obtained from: Early vs. Late Fall Calving; Spring vs. Fall Calving; Methods of Calf Raising; Value of Cotton Seed Hulls as Compared with Johnson Grass Hay; Value of Blackstrap Molasses for Feed; Cost of Raising Calves and Hay or Pasture for young Calves. In addition to these projects, there are other important lines on which some work has

been started, but we do not have funds for the proper carrying out of these new projects.

PLANT PATHOLOGY.

This work is in the Department of Botany and Forestry and is being done by Mr. D. C. Neal. The work was started a little more than a year ago, but good progress has been made. Some good data has been obtained on tomato diseases, diseases of the sweet potato, pecan scab, and corn root rot. In addition to these projects a survey is being made of the plant diseases of the State. This work is done in cooperation with the U. S. Department of Agriculture and the Mississippi Plant Board. The funds for plant disease work are inadequate, and we hope to be able to secure an increased appropriation for this important line of work.

HORTICULTURE.

Experimental work in Horticulture has been neglected at this Station for more than ten years, because there have been no funds available for this work. A small appropriation was made by the last Legislature which enabled us to employ Professor J. C. C. Price for half time, the other half time being devoted to teaching. The work is important enough to have one or more all time men. Considerable progress has been made with the various projects, which include apples, peaches, grapes, Japanese persimmons, figs, strawberries, and sweet potatoes. Several years will be required for result from many of these projects as the orchards were, for the most part, started new last winter.

POULTRY.

Professor E. P. Clayton, is in charge of this work and devotes one-half of his time to it. The work consists of a feed test with the different breeds of chickens, each breed getting the same feed to determine their economic value as egg producers. The tabulated results included in Professor Clayton's report, attached, are very interesting.

Another experiment with poultry is a comparison of some of the important protein feeds as to their relative value as egg producers. The three feeds that were used were: cotton seed meal, beef scraps, and skimmed milk. Valueing eggs at twenty-five cents per dozen, the cotton seed meal was worth \$240.00 per ton, beef scraps \$250.00 per ton, and milk \$16.40 per ton.

FARM MANAGEMENT.

The work in this Department is in charge of Mr. J. N. Lipscomb, who succeeded Mr. R. W. Clothier, Mr. Clothier having resigned last year. Some valuable results have been obtained on the different projects under way, which include farm surveys in Jones and Copiah Counties, a survey of 100 or more farms in Bolivar County, the survey of an area in the northern brown loam soil, and a boys' Farm Management Club. The last project is

one in which boys are interested in keeping farm records and is one by which the Department is accumulating very valuable data at a small cost. The work of this department is exceedingly important and it is hoped that we may be able to push the operations, as information on the various lines are badly needed.

FARM TRACTOR AND MACHINERY.

Realizing the very great need of information on the various tractors and other farm machinery on the market, we began last year in a small way to do as much testing of these as our funds would permit. Mr. F. C. Cottrell did some valuable work in comparing several different makes of tractors as to their durability, their adaptability to the stiff soils of the Station Farm, and the expense or cost per acre for each. In addition, good results were obtained with power cultivators, different hay machinery, and methods of saving hay.

There is so much machinery on the market for sale that often times will not work, that I feel sure this work should continue and on a much larger scale. We receive many inquiries as to what is the best tractor, the best motor cultivator, or the best of many other types of farm machinery. We should be able to give this information. In all sections of the State one can find worthless tractors and other farm machinery that have been junked because they were no good. No doubt many thousands of dollars are spent annually by farmers for machinery that is practically worthless.

SOUTH MISSISSIPPI BRANCH STATION.

Mr. Ferris' report which is attached, gives a detailed account of the work at this Station. During this period considerable improvements have been made in remodeling the dairy and mule barns, a new office building put up, also two new tenant houses, and a sweet potato curing house. In addition to this building, considerable fencing has been done.

Last year Mr. F. B. Richardson was employed to assist Mr. Ferris. His work is entirely with the truck and fruit crops. South Mississippi is especially adapted to the growing of these crops and information on the varieties, cultural practices, and fertilizers is badly needed. Good progress has been made in getting these projects started. Something like thirteen acres have been set aside for this horticultural work.

OLD McNEILL STATION.

The work at this Station is conducted jointly by the Central Station and the Bureau of Animal Industry of the U. S. Department of Agriculture. The work is principally along livestock lines, such as feeding steers, utilizing native grown feeds; the grading up, by the use of pure bred bulls, the native cows of that section; and the making of permanent pastures. Also, some work is being done with animal parasites, sheep, hogs, and the testing of many varieties of forage crops. The Bureau of Plant Industry of

the U. S. of Agriculture has recently furnished us an Agronomist for the forage crop work there.

HOLLY SPRINGS BRANCH STATION.

At this Station much new equipment has been added in the way of farm machinery, a new concrete silo, potato curing house, milking machine, a milk house, equipped with boiler, and other labor saving machines. Repairs have been made to the dairy barn and some fencing done.

The work done by Mr. Ames is of much value to the farmers of the Brown loam section. The results he has obtained with legumes and fertilizers are exceptionally good. The principal projects at this Station are as follows: Fertilizers for the various crops, control of soil erosion, cotton, corn, small grains, legumes, sweet potatoes, dairying, and the testing of fruits adapted to that section. A detailed report made by Mr. Ames is attached.

DELTA BRANCH STATION.

The last Legislature gave all the Branch Stations increased support funds, the appropriation for support for the Delta Station being \$17,000 annually. In addition to this amount, the Legislature authorized the use of \$20,000 from Sales Fund for the biennial period for a new home for the Assistant Director, for remodeling other buildings, fencing, and tile drainage. The increased appropriation enabled us to employ a Plant Breeder, to give his whole time to breeding new strains or varieties of cotton, corn, and oats for the Delta section. Mr. W. E. Ayres has charge of the plant breeding work and the results obtained have been satisfactory.

Mr. G. B. Walker, who is in charge of the work at this Station, has about completed the new building, the arrangement of other buildings, and the beautifying of the Station grounds. A complete report from Mr. Walker is attached.

RAYMOND BRANCH STATION.

This Station was authorized by the last Legislature, and a small appropriation made for the purchase of lands, erection of buildings, and for support. After several months delay, the location was finally made near the Agricultural High School grounds at Raymond, Hinds County, Mississippi. The County donated eighty acres, the Agricultural High School donated forty acres, and the Board of Trustees purchased fifty acres, making a total of 170 acres. The home for the Assistant Director has not been finished, but is being occupied by him at the present time. A good mule barn has been completed, except painting. Some ditching has been done and much improvement in the way of clearing the lands of bushes and briars has been done.

Mr. C. B. Anders, who is in charge of the work there, has done well with the small appropriation at his disposal. In fact, the support fund being only \$5,000 annually, means that he can conduct the work only on a very small scale. Out of this, salaries must be paid, seed, fertilizers, and equipment of all kinds bought. After this is done there is but little

left for labor. Mr. Anders has the experimental fields in good shape and some work started with varieties of corn and cotton, the different kinds of clovers, and the different fertilizers. We hope to receive sufficient appropriation next year to properly equip this Station for the work it must undertake.

PUBLICATIONS.

An appropriation of \$2,500.00 for printing bulletins by the last Legislature has enabled us to publish practically all the material we have ready. There are four or five more publications to be printed before the close of this year. The bulletins printed since last year are as follows:

Experiment Station Bulletins.

No.

- 187—Cotton Experiments in 1920.
- 188—Report on McNeill Branch Experiment Station.
- 189—Corn at Holly Springs Branch Experiment Station.
- 190—Sweet Potatoe Diseases and Their Control.
- 191—Mosaic Diseases of Sugar Cane.
- 192—Cotton at Holly Springs Branch Station.
- 193—Annual Report, Holly Springs Branch Station.
- 194—Report, South Mississippi Branch Station.
- 195—Dusting and Spraying Peaches.
- 196—Cotton Experiments in South Mississippi.
- 197—Corn Experiments, Central Station.
- 198—Corn Variety Tests, Delta Branch Station.
- 199—Sugar Cane for Syrup Making.

Experiment Station Circulars.

- 35—Cotton Variety Tests, Delta Branch Station.
- 36—Cotton Variety Tests, Delta Branch Station.
- 37—Why Not Plant Home Grown Cotton Seed.

Technical Bulletins.

- 9—Bark Beetles in Mississippi.

NEEDS OF THE STATION.

During the time of high prices, we have maintained the same organization with increased salaries, and with everything needed for experimental work, costing from two to four times as much as it formerly cost. To do this all surplus animals and farm products were sold and the money used for running expenses. The closing out of the mule breeding experiment gave quite a nice sum. The same is true of reducing the size of the grade beef herd. The animals sold were no longer needed for experimental work or for teaching purposes. We now find ourselves confronting the problem of cutting out some of the very important lines of work unless we

can get State appropriation. The Federal funds are budgeted, so that most of the departments get some of this money, but a few of the departments cannot possibly exist on what is allowed for them, since the Sales Fund is now something like one-fourth what it was three years ago. This is especially true of the Animal Husbandry Department. For properly equipping this department with good pure bred animals of the several classes for student and experimental work, a careful estimate made by Dr. Barnett and Mr. Goodell shows that \$15,000.00 is needed for this purpose. In addition \$10,000 annually is needed for the support of the Department. When once well established the Department should be almost self-supporting.

There are no facilities at present where classes can be taught stock raising. A judging pavilion or some assembly place should be provided where classes can get this instruction as per schedule. At present this teaching must be done in the open, that is, in paddocks, pastures, or wherever animals can be herded. Frequently, the students miss this instruction on account of weather conditions. Further, if the same animals are to be used for teaching that are used for experimental work, it is necessary that they be handled by some responsible person and in such manner as not to interfere with the results of the experiments. In a judging pavilion where stalls are provided and where the animals will be housed, this can be done.

The Departments of Agronomy, Plant Breeding, and Bacteriology are fairly well provided for in the allotment of Federal Funds.

The Department of Entomology gets only \$1,500 Adams Fund, for the projects it has under way. This is not enough to do the work as it should be done and it is impossible to allot any more Federal Funds to the Department. There are several other very important lines of research work that should be undertaken as is clearly shown in Professors Harned's report. If we could get an annual appropriation of \$2,500 some very important work could be started.

Professor J. S. Moore, in his report indicates that the work in the Dairy Department is handicapped for lack of funds. A separate laboratory and a section of a barn are badly needed. Also, a fellowship man can be used to assist in the work. An annual appropriation of \$5,000 is needed for this Department.

From the report of Professors Beal and Neal, of the Department of Plant Pathology, we note that additional equipment and some assistance is badly needed, and that an annual appropriation of \$5,000 is necessary for the best work in this Department.

The work in the Horticultural Department should be expanded. The report of Professors McKay and Price, clearly shows the need of additional funds for the work in this department. For the salary of an all-time man, and for seed, labor, fertilizers, etc., an annual appropriation of \$5,000 is needed.

The small appropriation for research in the Poultry Department is insufficient. It is enough however, to get started, but to do what should

be undertaken, an annual appropriation of \$3,500 is needed.

Professor J. N. Lipscomb is doing good work with the appropriation he is now receiving. In order to interest the Farm Management Department of the U. S. Department of Agriculture in a number of cooperative projects, we need additional funds as they agree to cooperate on a fifty-fifty basis. For this work an annual appropriation of \$5,000 should be made.

As pointed out heretofore in this report, some information on tractors and other farm machinery is badly needed. It will be necessary to employ an expert in these lines for this work. Some equipment must be bought and it will be necessary to employ some skilled labor, pay freight on machinery, etc. If we could get an annual appropriation of \$5,000, this could be started in good shape.

ADDITIONAL OFFICE AND LABORATORY SPACE.

The Station employees are very much in need of suitable quarters. The different men are now housed in insufficient quarters in the different buildings on the College Campus. Many of them do not have sufficient office and laboratory space. For best results, some provision should be made whereby the different workers could be housed for the most part in the same building. The College is very much in need of an Agricultural Building. If a building for this purpose could be had, the space in this, the old Science Hall, which is being used by many departments of the Agricultural School, could be used by the Experiment Station and Extension Division, which would relieve the situation.

TRAVEL AND OFFICE EXPENSE.

It is necessary for the Station Director to do a great deal of traveling in the interest of the Stations. This includes trips to the Branch Stations, to agricultural meetings and conferences, and to many sections of the State. It is also necessary for many of our workers or specialists to go to the Branch Stations to assist in the work there. It is always helpful for the specialists to attend the scientific meetings of their associations. The Station work is benefited from these trips in that the men come in contact with workers from all over the country who are engaged in similar work, and the discussions heard and information obtained are such as to enable the men to do much better work. Other Stations usually pay the expenses of their men to one or two of these meetings annually. The Southern Agricultural Workers Association always holds its meetings in some central place in the South. These meetings are of particular interest to the agricultural workers in the South and every experimental worker should attend them. In addition to the travel, certain expense in the office is such that the State Funds should share. For the travel and office expense an annual appropriation of \$2,500 is needed.

COUNTY EXPERIMENTAL FARMS.

It is my opinion that we now have enough Branch Stations. The overhead expense in buildings, lands, and a high priced man as assistant direc-

tor in charge, is large. We now have a Branch Station on all of the important types of soil and there is no use duplicating further than to make tests of that which has been discovered at the Stations. For this purpose a system of County Test Farms is needed. These may or may not be located at the Agricultural High Schools, but should be located at some easily accessible point. Until we can do experimental work in every county we cannot give accurate information as to the best fertilizers, the best varieties of the different crops, etc.

COOPERATIVE WORK.

If impossible to get these test farms established, I especially recommend that an appropriation be made for fertilizer tests, variety tests, etc., in each County. Our Plant Breeder is developing many improved strains of corn and cotton that should be tested out under the conditions that exist in the several Counties. This County work, I consider, especially important. It is work that should have been developed several years ago. A minimum of \$10,000 annually, will be needed for this work.

PECAN DISEASES.

The pecan industry in South Mississippi is one of the big industries of that section. There are many diseases that attack this crop, the treatments of which are not very well known. We have had several letters from the large pecan growers of that section, requesting that we do some experimental work on pecans to help them out. The Experiment Station has never done anything to assist this very important industry in the State and I believe that we cannot do a better piece of experimental work in South Mississippi, than that of looking to the control of the pecan diseases and the best methods of handling pecan orchards, etc. For this purpose we should have at least \$2,500 a year.

PRINTING FUNDS.

For the expense of printing and mailing out the bulletins and circulars, and the giving out of information by other methods, we will need the same appropriation as we are now receiving, which is \$2,500 annually.

BRANCH STATIONS.

The needs of the Branch Stations are not so many as for the Central Station. At the South Mississippi Station, located at Poplarville, and the Holly Springs Station, we can get by with the same support as we are receiving at present and on less improvements. An annual support of \$15,000 and \$300 for printing bulletins for each of the next two years, and \$2,000 for the biennial period for building and repairs, will be sufficient for each of these Stations.

At the Delta Station, located at Stoneville, we need the same annual support as at present, or \$17,000. In addition, \$5,000 is needed for the

building of a modern seed storage building and ginnery. Owing to the nature of the work at this Station in breeding new strains of cotton, it is necessary to have this equipment if the Station is to serve the best interest of the Delta section.

At the Raymond Station we need at least \$5,000 for completing the residence and for building a small dairy barn, implement shed, other small outhouses, and for fencing. If the station is to be developed as it should be, an annual appropriation of \$10,000 is needed.

Salaries.

The work of the Station has suffered considerably because we have not been in position to pay salaries sufficiently large to hold good men. Several of our workers have left us for positions at other institutions. The salaries for men at this Station are uniformly lower than at any other Station with which I am familiar. Where good technically trained men are employed for this work, they should be paid in proportion to their training, and for the eleven and one-half or twelve months they actually work. These men do not have opportunities to get out and make extra money during the summer months, or to go to summer schools, or take the three or four and one-half months vacation. It is to be hoped that the time will soon come when these men can be paid what they are worth.

SUMMARY OF NEEDS FROM STATE LEGISLATURE

	1922	1923	Total
For the Central Station	\$ 57,000.00	\$ 52,000.00	\$109,000.00
For the South Miss. Branch Station			
Poplarville	16,300.00	16,300.00	32,600.00
For the Holly Springs Branch Station	16,300.00	16,300.00	32,600.00
For the Delta Branch Station	20,000.00	19,000.00	39,000.00
For the Raymond Branch Station ..	13,000.00	12,000.00	25,000.00
	<hr/>	<hr/>	<hr/>
Total	\$122,600.00	\$115,600.00	\$238,200.00

We have gone over these estimates carefully, and, after having consulted the heads of the departments interested, we feel that they are very conservative, and as low as is consistent with efficient work.

Respectfully submitted,

(Signed)

J. R. RICKS,

Director.

FINANCIAL STATEMENT.

The following statement gives the funds available for the work of the Experiment Station for the year 1920-21.

From the United States Government (Hatch Fund)	\$15,000.00
From the United States Government (Adams Fund)	\$15,000.00
From Sale of Farm Products	\$10,947.13

Disbursement from Experiment Station Funds 1920-21.

	Hatch	Adams	Sales
Salaries	\$ 9,587.55	\$10,344.82	\$ 579.05
Labor	3,874.23	3,198.82	1,470.13
Publications . . . . .	.....	.....	406.25
Postage and Stationery	39.74	.....	275.38
Freight and Express	32.28	288.48	257.06
Heat, Light, etc.	382.16	124.51	1,016.65
Chemical and Laboratory Supplies . . . . .	.....	328.28	61.59
Seeds, plants, and supplies	274.71	208.75	1,791.37
Fertilizers	100.18	.....	3.00
Feeding Stuffs	709.15	154.25	1,787.60
Library . . . . .	.....	76.24	24.00
Tools, Machinery, etc. . . . .	.....	.....	.....
Furniture and Fixtures . . . . .	.....	.....	235.80
Scientific Apparatus . . . . .	.....	211.55	.....
Live Stock . . . . .	.....	.....	1,751.05
Traveling Expenses . . . . .	.....	64.30	863.94
Buildings and Lands . . . . .	.....	.....	325.27
Contingent Expenses . . . . .	.....	.....	98.93
Total	\$15,000.00	\$15,000.00	\$10,947.13

Funds from State of Mississippi.

Receipts and Disbursement for Central Station.

Balance	\$10,144.78
Receipts—State Treasurer—Bulletins	1,250.00
Receipts—State Treasurer—Plant Diseases	3,500.00
Receipts—State Treasurer—Horticultural	2,000.00
Receipts—State Treasurer—Dairy	3,500.00
Receipts—State Treasurer—Poultry	2,500.00
Receipts—State Treasurer—Live Stock	6,000.00
Receipts—State Treasurer—Farm Management	1,750.00
Receipts—State Treasurer—Fellowship	450.00
Receipts—State Treasurer—Sundry	44.92
Total	\$31,139.70

Disbursements.

Bulletins	\$ 2,941.91
Plant Diseases	4,896.71
Horticultural	3,204.85
Dairy	5,359.58
Poultry	3,840.42
Live Stock	2,996.51
Farm Management	3,018.80
Fellowship	1,364.21
Balance	3,516.68
Total	\$31,139.70

Delta Branch Station.

	Disbursement.	Receipts.
RECEIPTS:		
Balance, July 15, 1920		\$ 4,703.46
State Treasurer	\$17,000.00	
State Treasurer, Sundry	10.00	17,010.00
DISBURSEMENTS:		
Supplies	\$ 5,021.58	
Salaries and Labor	14,000.57	
Equipment and Repairs .. .	2,185.07	
Power, Heat, Lights, Water	124.20	
Sundry	751.84	\$22,083.26
By Balance July 2, 1921.		369.80
Total	\$22,083.26	\$22,083.26

Raymond Branch Station.

	Disbursement.	Receipts.
RECEIPTS:		
State Treasurer		\$12,000.00
DISBURSEMENTS:		
Supplies	\$ 1,626.33	
Salaries and Labor	4,448.88	
Equipment and Repairs .. .	6,081.20	
Sundry	69.88	\$12,226.29
By Balance July 2, 1921.		226.29
Total	\$12,226.29	\$12,226.29

South Mississippi Branch Station

	Disbursement.	Receipts.
RECEIPTS:		
Balance July 15, 1920		\$ 3,303.51
State Treasurer	\$20,250.00	
State Treasurer Bulletins .. .	500.00	
State Treasurer, Sundry .. .	2,106.96	
Total		\$22,856.96
DISBURSEMENTS:		
Supplies	\$ 7,814.27	
Salaries and Labor	11,701.72	
Equipment and Repairs .. .	4,790.06	
Travel	76.63	\$24,382.68
To Balance July 2, 1921.		1,777.79
Total	\$26,160.47	\$26,160.47

Holly Springs Branch Station.

Disbursement. Receipts.

RECEIPTS:

Balance July 15, 1920	\$ 5,545.59	
State Treasurer .. .	\$22,962.57	
State Treasurer, Bulletins .. .	500.00	
<hr/>		
Total .. .		\$23,462.57

DISBURSEMENTS:

Supplies .. .	\$ 6,717.61	
Salaries and Labor	15,520.95	
Equipment and Repairs	5,531.60	
Travel .. .	66.86	
Power, Heat, Lights, Water .. .	100.82	
Sundry .. .	81.25	\$28,019.09
<hr/>		
To Balance July 2, 1921.		989.07
<hr/>		
Total .. .	\$29,008.16	\$29,008.16

ANNUAL REPORT OF THE AGRONOMY DEPARTMENT.

To The Director:

Sir:

I herewith submit a brief report of the work of the Agronomy Department the past year.

Changes in the Department.

The Agronomy and Plant Breeding Departments have been combined under one management. C. B. Anders resigned as Assistant Agronomist to become Assistant-Director of the Raymond Branch Station and J. F. O'Kelly, Fellow in Plant Breeding, was promoted to this position. W. E. Ayres was employed by the Delta Branch Station as Plant Breeder and is working in cooperation with the department here. D. W. McIlwain was made Superintendent of the field work. I. P. Trotter held a fellowship in Agronomy during the first part of the year, and worked out an interesting thesis on the subject of "The Value of Various Carriers of Phosphorus as Fertilizers." Following Mr. Trotter, L. C. Greaves was elected to the fellowship in the department. He has a problem, "Pastures in Mississippi."

FERTILIZER WORK.

Phosphorus Fertilizer Under Cotton.

Mr. Trotter's work with various phosphorus fertilizers, showed it to be unprofitable to use acid phosphate. raw rock phosphate, Florida soft

phosphate, and Duplex Basic phosphate on the valley soil here on the Station farm. Raw rock phosphate and flowers of sulphur, when used separately, appeared to have a depressing effect, but when used together gave a considerable gain over the check. The stable manure used in the experiment for the purpose of comparison gave very profitable gains, both when used with raw rock phosphate and without. Better yields, however, were obtained without the phosphate.

Nitrogen Fertilizer Under Corn.

Calcium cyanamid, ammonium nitrate, and nitrate of soda were applied to corn when knee to waist high, at the rate of 100 and 200 pounds per acre. The average grain for the cyanamid was 6.9 bushels per acre, the ammonium nitrate 14.4 bus., and the nitrate of soda 15.2 bushels. 200 lbs. per acre gave better gains than 100 pounds, but was not as profitable to use on account of the extra cost of the fertilizer. Nitrate of soda was also applied at the rate of 200 pounds per acre to two series of the corn variety test where a part of the plants had turned yellow and become stunted by continued wet weather. The plants receiving the nitrate produced 10.1 bushels more per acre than the adjoining check plats that received no fertilizer.

Lime in a Cotton, Corn, Oats, and Legume Rotation.

The lime rotation experiment that has been running for several years was continued the past year. A study of the results obtained the past two years fails to show any consistent gain for any form or amount of lime used. Continuous cropping following the rotation mentioned does not seem to be decreasing the yielding power of the plats.

SOIL FERTILITY WORK.

Tests of Various Crop Rotations.

The crop rotation work that has been in progress for eleven years was continued. A few results obtained the past season are of some interest. In plats cropped to corn continuously, cowpeas sown at last cultivation gave an increase of 7.7 bushels of corn per acre. Cowpeas and residual effect of five tons manure per acre applied the year before gave an increase of 9.8 bushels per acre on soil naturally less fertile than the check plat. The plat in oats and vetch, and cowpeas continuously yielded 639 pounds more oats and vetch per acre than the average plats in rotations containing corn and cotton. Plats in cotton continuously yielded 767 pounds more seed cotton per acre where five tons manure were applied annually. Where oats and vetch, and cowpeas were in a rotation, corn made 8.4 bushels per acre more than in a corn-cotton rotation.

Effect of Certain Legumes on Soil Fertility.

An experiment has been started to determine the relative value of cowpeas, soy beans, and velvet beans for increasing soil fertility, both when used alone and when planted in corn. Wheat is planted on all the

plats following the legumes and used as a measure of fertility. The plats from which the legumes were not removed yielded more than 50% more wheat than the ones from which they were removed. The legume bearing plats yielded 43% more wheat than the ones which had no legumes. It will be necessary for the experiment to run several years before reliable data can be obtained on relative fertilizing value of the different legumes used.

VARIETY STUDIES.

Soy Beans.

A soy bean variety test containing seven of the most prominent varieties for Mississippi was carried on. The beans were planted April 17. The season being rather unfavorable, the yields were low. Haberlandt led in yield of seed with 20.5 bushels per acre, but several other varieties produced more stover.

Corn Variety Work.

Corn variety studies were carried on on both hill and valley land and two plantings were made on valley soil, one in March and the other the first of July.

Tennessee Red Cob-72, Hastings, and Cocke's Prolific, were leading varieties in the early valley land test, with a yield of from 53.8 to 56 bushels. In the hill land test, Station Tennessee Red Cob, Hastings, North Carolina Prolific, Paymaster, and Vardaman were leading varieties with yields ranging from 17.8 to 18.7 bushels per acre. Laguna, Mexican June, and Goliad led in the late test by a considerable margin, their yields ranging from 30.7 to 40 bushels per acre. These varieties are all of much the same type and appear to be better adapted to late planting than the varieties that ranked well in the earlier plantings.

Cotton Variety Work.

Both hill and valley tests were conducted with cotton. The yields were low on account of heavy boll weevil damages. In the valley land test, Foster-120-6102, Trice-270-41, and Piedmont Cleveland led in production of seed cotton, but in money value of lint and seed, the three leaders were Foster-120-631, Foster-120-6102, and Hartsville-12. It is gratifying to note that the leaders in both production and money value were strains produced by the Experiment Station.

In the hill land test, Miller and Cleveland Big Boll made the best yields. The big boll cottons are apparently better adapted to hill land conditions. Results for some years justify this conclusion.

BOLL WEEVIL WORK.

In 1920 boll weevil poisoning tests with calcium arsenate were made on four different fields of cotton on the College Farm, ranging from three and one-fourth to eight acres in size. In addition to this, the poison was used on twenty-one multiplying patches and small cuts of cotton planted

for various other experiments. In all cases, infestation counts showed that the poison checked the weevil to some extent, and in most cases yields were increased somewhat, but in but one field was the gain sufficient to more than pay for the poison and the labor of putting it on. Perhaps we were not working under the most favorable conditions for the poison to be profitable, but very favorable conditions will not prevail under practical farm conditions a very large part of the time.

BREEDING LEGUMES.

In 1920 a number of plant selections were made of hop clovers, bur clover, black medic, white clover, red clover, and alfalfa, growing wild in the fields and pastures about the College. These selections were planted in progeny rows and some rather interesting results secured, especially with the hop clovers. Several different types have been obtained, some of which will doubtless prove to be of more than average merit. The wild hop clovers are of considerable value as pasture plants for early grazing and it stands to reason that they may be improved by breeding.

Several foreign vetches and bur clovers furnished us by the U. S. Department of Agriculture, have been tried out in observation rows and one or two seem to show special merit. These will be multiplied and if they continue to be satisfactory, will be distributed.

CORN BREEDING WORK.

Corn breeding work similar to the work of the preceding year was carried on. The main problem is to determine what are the characteristics of parent strains that are essential to the production of high yielding hybrid progenies.

This problem has been attacked by making numerous crosses between different types of southern corns, comparing yields of the hybrids with their parents, and noting characteristics of parents. In 1920, thirteen different varieties were crossed, the highest yielding combination being a cross between Cocke's Prolific and Hickory King. This cross yielded 1.2 bushels more than any variety in the test.

On account of the fact that corn varieties are not generally pure, it was thought that it might be well to produce some pure strains of different varieties by inbreeding, then study their characteristics and make crosses later. Several interesting strains have been isolated in this way, but the study has not progressed far enough for definite conclusions.

Mass selection, plant selection, and progeny row work have been continued with the idea of improving certain varieties, or producing better yielding strains for the farmers of the State. One of our selections, Tennessee Red Cob-72 yielded 56.9 bushels per acre the past season. This was a better yield than made by any other variety in the test. If this strain continues to produce well it will be multiplied and distributed.

COTTON BREEDING.

Work was continued on all divisions of the cotton breeding project.

Our study of heredity in the cotton plant has failed to show conformity

to laws of heredity in some respects and we have thought that this might be due to the fact that the varieties we used were not genetically pure. To determine this we are producing some pure strains by inbreeding for a series of years. These will later be crossed and hybrids studied. The past year but little was done on this division of the project except inbreeding certain varieties.

Considerable work was done along the line of breeding improved varieties. An effort is being made to produce better wilt resistant, better yielding early short staple, and better long staple varieties. This work is carried on by means of plant selection and progeny row testing, by hybridizing varieties, and by acclimatizing imported varieties. Encouraging results are being obtained in this work. In both 1919 and 1920 one of our selections led in production in the test of wilt resistant varieties. At three of the Experiment Stations our strains were leaders in money value. Foster-120-6102 is one of our most promising new strains. It is very early and very prolific with a staple about $1 \frac{3}{16}$ inches in length. A field of this strain at the Delta Station produced a bale and a half per acre the past season. Seed of this strain are being distributed.

The acclimatization work carried on in cooperation with the North Carolina and Texas Experiment Station was continued. Seed grown in Mississippi again produced slightly better yielding plants than seed grown in the other states mentioned.

But little time was spent on the work with natural crossing in cotton except to complete some data on work started the year before, and to multiply the seed of Winesap cotton so that more extensive experiments could be carried on in 1921.

The preliminary work on the effect of continued selection in pure lines has been discontinued on account of the fact that such characters as lint length and lint per cent were very difficult to measure accurately, and did not lend themselves well to such a test. The pure lines are being continued and will be used as foundation stock for breeding and heredity studies.

Publications.

Two bulletins, Mississippi Experiment Station Bulletin No. 187, "Cotton Experiments 1919 and 1920," and Mississippi Experiment Station Bulletin No. 197, "Corn Experiments" were published the past year by this department. There were also one Station circular and four press circulars issued.

Work in 1921.

The present year most of the work mentioned in the above outline for 1920 is being continued and in addition work is being done on several other projects, among which we may mention additional cotton breeding work at this station in an effort to produce a better short staple variety for the east-central part of the State; corn and cotton breeding work at both the Holly Springs and South Mississippi Branch Stations; a cooperative cotton fertilizer experiment on flat-woods soil; an experiment to determine the relative value of cotton seed and cotton seed meal as a fertilizer for cotton;

the use of sulphur as a fertilizer for alfalfa; the use of nitrate of soda as a fertilizer for oats; variety work with oats and rye; cultural work with corn, including spacing work, different depths of cultivation, the use of heavy application of commercial fertilizers, heavy application of barn manure, heavy application of green legume manure, and different ways of planting; sorghum variety test, testing for ensilage purposes and also for syrup making; and some preliminary pasture work.

With the two old departments combined and with our present organization, we believe that we can do more work and do it more satisfactorily than in the past.

INCREASING THE SERVICE OF THE DEPARTMENT.

Cooperative Agronomy Work.

It seems to us that we have already outlined all the projects that it would be wise for our present force to attempt to handle, but there are other lines of work that would be of service to the people of the State, and we believe that it would be wisdom on the part of the State authorities to provide means for carrying them on. Local fertilizer tests should be made in many counties of the State so that the people of different localities may know with a certainty the amount and kinds of fertilizers their soils should have to produce best. Numerous community variety tests of corn, cotton, and perhaps other crops, should be conducted so as to prove to the people of the community just what varieties they should use. Many inferior varieties are being grown in the State at present, and the best, if not the only way to get the people to change to new and better ones, is to give them a chance to see their variety grown by the side of a better one in a local test.

There is also need for someone to encourage the multiplication of pure seed of improved varieties and to assist in their distribution. A large part of the improved seed now put out by breeders is soon lost by mixing, due to ignorant handling.

We believe that an agronomist should be employed to superintend cooperative fertilizer and variety test experiments in various counties of the State and to assist in the multiplication and distribution of good seed. A part of the work could be done in co-operation with agricultural high schools, and county agents. With good local helpers one man could cover a wide field.

Pasture Work.

In recent years the people of the State have taken increased interest in growing livestock and in dairying, and these industries must be developed for the State to have a well balanced system of agriculture. Good pastures are the foundation of profitable livestock growing. We need more and better pastures. Thousands and thousands of acres are lying out and producing practically nothing. We need much more information about methods of establishing and handling pastures, and about best grasses and

legumes to use under different conditions. There is no doubt a possibility of improving some of our native grasses and legumes by breeding work, and thus making them more useful.

An appropriation for the purpose will be necessary before this department can do any additional pasture work.

Thanking you for your interest in our work and hearty cooperation, this report is respectfully submitted.

(Signed) H. B. BROWN, Plant Breeder.

J. FRED O'KELLY, Asst. Agronomist.

ANNUAL REPORT OF THE ANIMAL HUSBANDRY DEPARTMENT.

To the Director:

Sir:

The report of the work of the Animal Husbandry Department for the last year is necessarily only general in scope, due to the change in the personnel of the department made necessary by the resignation of Professor D. J. Griswold, whose work is largely being taken over by C. J. Goodell. Having only recently taken over the work of this department, it has been impossible to go into the work in detail, which, however, will be done in the near future for publication. This report is based upon the available records compiled by Mr. Griswold.

Beef Cattle.

The beef cattle work conducted during the past two years included:

1. A study of the use of pure bred bulls on grade cows bred up from the common run of beef cattle in Mississippi.
2. The maintenance of a small number of pure bred beef cows.
3. Securing of data on the cost of wintering calves, yearlings, two-year-olds, and cows.
4. Comparison of rations for finishing beef steers in Mississippi.

The bulls used in the work of grading up were of good individuality and breeding representing the Hereford, Shorthorn, and Angus breeds. Yearlings and two-year-olds by the Angus bull, Holly Elmore, show excellent individuality. The Shorthorn bull, Victor Avon's 2d, secured shortly before the beginning of this biennial period, and the Hereford bull, Enoch's Prince, secured just at the close of the last period, have been developed into good herd bulls, each showing good lines and weighing over a ton in breeding condition. Victor Avon's 2d has developed a somewhat vicious disposition, making it desirable to sell him as the bulls kept by the Station are used for class work and should be easily handled. The Station acquired during the present biennial period the Angus bull, Ames Plantation Bruce, and the Shorthorn bull, Fernoak Albino. The calves by Ames Plantation Bruce are showing up well, as are the calves by Enoch Prince. The Angus bull, Holly Elmore, was sold by the Experiment Station and the Hereford

bull. Beau Lucky, used before the purchase of Enoch's Prince is now in use at the Coastal Plains Experiment Station.

In the grade herd, the Experiment Station now has thirteen grade Shorthorn cows, twelve grade Angus, and ten grade Hereford cows, fifteen two-year-old heifers, and thirteen yearlings, also, nineteen two-year-old steers. The steers are being used in the steer feeding work.

For the purpose of studying their adaptability and for the demonstration and student use, the Station has maintained a few pure bred cows, representing the three leading beef breeds. Two Shorthorn heifers of Scotch breeding were recently purchased with the view of forming the nucleus for a choice herd.

During the past two years, records have been kept of the feed consumed by calves during the winter. This past winter records were kept of the feed required to maintain yearlings, two-year-olds, and cows. Cows were maintained satisfactorily on a ration of thirty pounds of silage, ten pounds of Johnson grass hay, and one and one-half pounds of cotton seed meal.

In the steer feeding work the most important project during the past year has been a comparison of the varying proportions of corn and cotton seed meal, fed in connection with silage for steers. Due to unfavorable market conditions, unless credit is given for the fertilizer produced, the steer feeding operations during this period were conducted at a financial loss. At the prices prevailing for corn in this section during the past two years, its addition to a ration of corn and cotton seed meal has not proved profitable. In 1919-20 the steers receiving molasses showed more profit than either the corn and cotton seed meal steers, or those receiving the straight cotton seed meal ration, indicating that more work should be done with this feed.

Swine.

The swine work conducted included: (1) Work with forage crops, and (2) Studies of the influence of feed on the firmness and quality of the pork. Some work was also done with molasses. The grazing work emphasized the value of green forage in the production of pork, and the value of alfalfa in a forage crop rotation. Soy beans and peanuts, hogged down, produced satisfactory and economical gains. A study of the effect of feeds on the firmness and quality of pork is being made in cooperation with the Animal Husbandry Division, Washington, D. C. Hogs fed exclusively on peanuts have been slaughtered to determine the influence of such feed on the pork. The results have then been tested of feeding hogs on corn and tankage after having been fed on peanuts. Representative hogs were shipped to Beltsville, Maryland from time to time and were slaughtered under the supervision of the Bureau of Animal Industry, the pork being graded by the Soft Pork Committee, representing the colleges engaged in soft pork investigations.

The soy bean work last year included four lots, as follows:

- Lot 1. Soy beans alone, hogged down.
- Lot 2. Soy beans alone, hogged down, 1 $\frac{1}{4}$ % ration of corn.
- Lot 3. Soy Beans alone, hogged down, 2 $\frac{1}{2}$ % ration of corn.
- Lot 4. Soy beans and corn, hogged down.

Preparations have been made to continue this work this fall.

Sheep.

The work with sheep has been a study of the use of pure bred mutton rams on native and grade ewes. Shropshire and Southdown rams are being used and the lambs show a marked improvement over their dams, both in fleece and mutton form. Stomach and intestinal parasites constitute the most serious obstacles to the sheep industry and the growing of ewe lambs to maturity is extremely difficult.

Horses and Mules.

The mule breeding project has been continued. This project will be completed in 1923 with the measurements as four-year-olds of the 1919 colts. During this period the Experiment Station acquired, through the courtesy of Honorable Paul J. Rainey, the saddle stallion, King, which is now being used on the Station mares and is being stood for service.

Coastal Plains Experiment Station.

Work at the Coastal Plains Experiment Station has been conducted in cooperation with the Bureau of Animal Industry, and is under the immediate supervision of S. W. Greene. This work includes the development of pastures, grading up from native foundation stock by the use of pure bred beef bulls, the feeding of steers, work with grasses and forage plants, and some work with sheep.

Progress of the work with pasture grasses show carpet grass to be the best grass to use as a foundation for permanent pastures in South Mississippi. It is able to establish itself in combination with other grasses and weeds better than any grass tested so far. Carpet grass and lespedeza have proven an excellent combination for pastures in the Coastal Plains area. The Coastal Plains Experiment Station has recently leased for five years, a pasture of 500 acres, located conveniently to the Station farm. This tract has been well fenced and will be used for grass and pasture improvement experiments with sheep and cattle.

The work with grasses and forage plants for the South, which was carried on at Biloxi by the late Professor S. M. Tracy, has been transferred to McNeill and there are now under trial some 200 grasses and forage plants.

In the grade cow herd there were this spring, thirty-nine cows and thirty-three calves. The Hereford bull, Beau Lucky, is being used at the head of this herd and his calves are showing up well. Records are being kept on the cost and maintenance of all stock at this Station. Some grading up work is being done with sheep by the use of Shropshire and Rambouillet rams.

The steer feeding work conducted at the Coastal Plains Station has

been for the purpose of testing out the value of velvet beans as a cattle feed. Steers fed on velvet beans put on as many pounds of gain and finish off equally as well as those fed all cotton seed meal. Two pounds of velvet beans in the pod have proven equal in feed value to one pound of cotton seed meal.

Respectfully submitted,
(Signed) E. BARNETT,
Chief of Department of Animal Husbandry.

ANNUAL REPORT OF THE DEPARTMENT OF BACTERIOLOGY.

To the Director:

Sir:

I have the honor to submit you the Ninth Annual Report of the Bacteriological work in the Experiment Station for the year ending June 30, 1921.

Green Manure Vs. Forest Leaves.

For three years we have compared the effects of turning forest leaves, green manure, and stable manure with an oat crop as an indicator of the fertilizing value. Though the results have been somewhat irregular, there have been some interesting things developed.

The soil, to start with in the year 1918-19, was a poor sandy soil from the farm which contained a very low amount of organic matter. The results this year show practically no effect from corn-stalks, forest leaves, and pine leaves. The next year the soil was not taken from the pot but recultivated and planted to oats again with results that corn-stalks, forest leaves, and pine leaves, all show an increase over the year before, while the check pots, alfalfa, cotton-stalks, and stable manure all show a decided decrease. The decrease in these latter, of course, would be expected since the first year these materials were rotted and consumed by the growing oat crop, while the dry corn-stalks, forest leaves, and pine leaves were only slightly decayed, almost no plant food from this source could be utilized by the oat crop. By the next year some more proportional decomposition had taken place in these materials than in the others and an increase in fertilizing effect was noted. The result in 1920-21 is unusual and must be verified before they can be accepted. The explanation may be as follows: The soil used was the soil from the pots of the year before. It had been placed in a large heap and thoroughly mixed. From the heavy dressing it will be seen that it contained a large quantity of organic matter, and therefore, was rich in bacteria. The bacteria were sufficient to tear down the corn-stalks, dry leaves and pine leaves and probably gave this increase.

Limit to the Amount of Green Manure Turned.

In order to determine the limit to the amount of green manure that can be turned and still produce an increase of crop grown over it, an experi-

ment was carried out with treatments as follows: 1. No alfalfa added. 2. 40 tons alfalfa, no lime. 3. 40 tons alfalfa and 3 tons lime. 4. 60 tons alfalfa and no lime. 5. 60 tons alfalfa and 3 tons lime. Two series were used, one cropped to oats, one not cropped, each series done in duplicate sets, one limed and one not limed.

The results show that the forty tons of green weight of alfalfa turned gave a larger crop of oats than the sixty tons; but the sixty tons gave a smaller growth than the forty tons. It will be noted also that lime added gave a large increase where sixty tons were turned. This indicates that one factor causing the decrease where large amounts are turned in is acidity. An examination of the soil root systems in the pots after harvesting the oats indicates that a part of the decrease is due to a lack of moisture. The heavy mass of sixty tons of alfalfa turned prevented the water from going through. The mass was not so well decayed as where sixty or forty tons were turned and the soil beneath was dryer and the root system not so well developed as in the other two.

Pounds of Nitrogen Per Ton.

This work has been continued on field crops. Samples of oats, alfalfa, and Johnson grass were collected and the nitrogen content determined. From results we find the poor oats giving the highest content of nitrogen. The oats collected were ripe and part had been cut and shocked. The proportion of the straw to the grain is likely giving this difference. There is but little difference in the case of alfalfa as was shown last year. We find the same true for Johnson grass as we did for oats, that is, the poorer Johnson grass gave the higher nitrogen content. Here it was noted when collected that there were more seed in proportion to the straw with the poorer grass, which was ripe when cut. In the experiment where the oats from the pots were harvested in the milk state, a difference of over 300% in the nitrogen content is noted, the poorer oats only having 14.1 pounds per ton, the better having as high as 77.4 pounds per ton of oat straw.

Soil Species.

These studies are continued. Twenty strains have been isolated and studied. Descriptions of their culture characters and morphology have been recorded. A comparison of these cultures with some obtained from Dr. Frost, of Wisconsin, Dr. Conn, of Geneva, N. Y., and the New York Health Laboratory, have been made. Also, an intensive study of colony characteristics, looking toward their use in classification, has been made by our Mr. Rowland Cowart.

Thanking you heartily for your continued cooperation and earnestly commending the work of my assistants, the above report is,

Respectfully submitted,

(Signed) CHAS. F. BRISCOE,

Professor of Bacteriology and Chief
in Bacteriology in the Experiment Station.

ANNUAL REPORT OF THE ENTOMOLOGY DEPARTMENT.

To the Director:

Sir:

I have the honor of submitting herewith a brief report of the Department of Zoology and Entomology for the years 1920 and 1921.

Adams Fund Projects.

I. A SYSTEMATIC AND BIOLOGICAL STUDY OF THE CRAWFISH OF MISSISSIPPI.

This work has been continued by Mr. R. N. Lobdell. In regard to his work for this year Mr. Lobdell reported as follows on May 21, 1921:

"I am now carrying on experimental control work on approximately 125 acres. 110 of these are at Muldon and 15 are at Prairie. The area at Muldon is said to include the worst crawfish land in the county. I have divided it into plots and check plots, using different methods of applying carbon bisulphide. The squirrel exterminator plan has proved already not to be a success, and I have abandoned it. On the latter half of the plots and for the second poisoning also, I am using the bottles with small canes inserted in the corks. These give 10 or so rapid but easily counted and large drops, these quickly stop waste by the creation of a partial vacuum in the top of the bottle. I am very much pleased with this system of applying the poison and believe it is the best one to be used by careless laborers. Yet, we are not at all sure that carbon bisulphide will in the end prove the best possible method of control.

"A second exterminant involves a rain-resistant-arsenical applied to young cotton plants. One plot was planted to cotton three times this season, but adverse conditions have prevented a stand until now. This third stand was poisoned on yesterday with the new formula rain-resistant-arsenical suggested to me by Prof. William Moore, of the University of Minnesota. The next heavy rain will show whether the crawfish will eat this treated product. There are very many burrows in this plot, and it will serve as an admirable illustration when later on corn is planted to the same land and its check. Corn, I think, has been eaten up on this land as late as the sixth of July. Another plot was treated on the 13th of April by scattering green alfalfa over the land which was thickly covered with open crawfish holes. The alfalfa had been dipped in arsenate of lead solution. That night a very great deal of it was taken into the burrows by the crawfish. This land has been plowed, but I regret to say that as we have had no rain during May, the remaining crawfish have not opened up their burrows very conspicuously. Without waiting any further for the possibility of a second round of any of the poisoned plots Mr. Jones, the manager, is this week and on next Monday and Tuesday planting all of the plots and check plots with the exception of the two in cotton to corn. If we

have a rain before the corn comes up, a rain heavy enough to make the crawfish burrows conspicuous, we will go over the land and give the poisoned plots a second round. The first rain after the corn is up should then cause a very marked difference in the stand on the poisoned plots and the checks, and at that time, I expect to get a good supply of photographs and counts to supplement the photographs and counts already made.

"At Prairie, there is an area planted in alfalfa early this spring. Part of this was poisoned by the cork and bit of cane method during April and now shows a decidedly less number of holes than the unpoisoned land. However, no very heavy rains have occurred since poisoning and the unpoisoned alfalfa is not conspicuously different in stand from the poisoned. Another area on which all freshly planted alfalfa was entirely eaten up has now been planted to cotton to be used as a trap crop, the planter being run over the flat harrowed surface in rows six feet apart. As soon as this cotton is up and has expanded the two first leaves, it will be sprayed with the Moore formula. Another seriously infected plot near to it has had a crop of corn already eaten off this spring. A fresh planting has just been made. On this land, we plan to scatter poisoned alfalfa immediately after the next rain.

"If the next week or ten days will give us a heavy rain, I expect to gain some interesting information. If the dry weather continues, I am rather afraid that the conspicuous results for photographing or sharp contrasts will be unobtainable this season.

"The life history and tiling plots are, of course, still running at A. & M. College—six plots. Also the tiling plot near Sessums, since 1914, and the life history plots at Rosedale—three most important ones."

During 1920 the crawfish work was largely along three lines as follows:

- (a). Life History Work on Nine Species (or subspecies).
- (b). Control Work on Two Species.
- (c). Distribution Survey Work on Nine Species (or subspecies).

a. The life history work deals with the determination for each species of migration and food habits; burrow types, situations and construction; mating and egg-laying habits; growth and care of young. The species being studied are: *Cambarus bartonii*, *C. bartonii fabricius*, *C. blandingii acutus*, *C. diogenes*, *C. diogenes ludovicanus*, *C. hayi*, *C. hagenianus*, *C. latimanus*, *C. sp.* (new species probably). The greater part of this life history data is being secured at 20 stations within a twelve mile radius of the College. It is important that it be supplemented by observation in other parts of the State.

b. Control work concerns itself with but two species: *Cambarus hagenianus*, the prairie crawfish, and *C. diogenes*, the delta crawfish. Notes are being kept on past and present populations of plats that are variously treated by poisoning, by tiling, by pasturing with pigs, by picking up the

crawfish at night, and by clean and frequent cultivation. An attempt is also being made to arrive at comparative costs.

c. The survey work has been carried on in several counties of the State. Much good material has been collected, but identifications have not been completed. It is probable that two species new to the State have been found and one possibly new to science.

II. A SYSTEMATIC AND BIOLOGICAL STUDY OF THE SCALE INSECTS OF MISSISSIPPI.

During the past two years excellent progress has been made on our study of the scale insects of the State. This work has been done in the laboratory of Miss Gladys Hoke. Inspectors of the Plant Board and correspondents throughout the State have assisted by collecting and sending specimens to us. Miss Hoke has also spent considerable time at the University of Illinois, where she has been working with Dr. A. D. MacGillivray, one of the leading authorities on scale insects. Almost daily, while Miss Hoke was at Illinois, we mailed scale insects to her for determination.

III. A SYSTEMATIC AND BIOLOGICAL STUDY OF THE INSECTS AFFECTING PECANS.

Some progress has been made in our studies of pecan insects. About fifty different species of insects have been under observation. Problems that have come up in connection with our studies of pecan insects have suggested several other important studies. Our lack of knowledge in regard to the bark beetles affecting pecans and the relation of the Hickory Bark Beetle to the pecan industry suggested the importance of securing a specialist to investigate these problems. Dr. M. W. Blackman, of Syracuse University, spent nearly a year in the State and the bark beetles have probably been more thoroughly studied in Mississippi than in any other Southern State. Dr. Blackman has already prepared two bulletins for publication and expects to have two or three more within the next year, as a result of his work in Mississippi.

The importance of the May Beetles (*Lachnosterna*) as pecan pests suggested a thorough investigation of this important group of insects and this has now developed into a separate project to which Mr. J. M. Langston has devoted considerable time, and many other members of our force have assisted to some extent.

Other Projects.

The Department of Zoology and Entomology receives no support from the Experiment Station except from the Adams Fund. The writer feels that this department should receive support from the Hatch Fund and other funds as they become available, as we are already working along various other lines and there are dozens of problems that should be investigated. Space will permit us to mention briefly only a few of the projects that have received some attention during the past two years.

Mr. H. W. Allen has made studies of (1) nematode parasites of young

calves, (2) of the hookworm infestation in new students at the College, (3) beneficial parasites of the Southern Grass Worm. In regard to these three projects Mr. Allen makes the following brief report:

"The department is cooperating with the Dairy Department in a preliminary study of nematode parasitism of young calves.

"During the fall of 1920, Mr. Earle Brintnall, Associate Dairyman, called the attention of this department to the unthrifty condition of several calves on feeding experiments. Subsequent fecal examinations, and autopsies indicated infestation by several nematode parasites, at least three of which were recognized as injurious to young calves. During the present season the study of these parasites is being continued with special reference to the relation between nematode infestation and general condition of the animal.

"During the fall term a survey of the hookworm infestation of new students was made with Dr. C. F. Briscoe, of the Department of Bacteriology and Dr. C. B. Mitchell, College Surgeon.

"The results of this survey were as follows: Residents of Mississippi, 323 negative, 35 positive, total 358—9.8%. Out-of-State residents (including foreign students), 30 negative, 3 positive—33 total. Total of new students examined, 353 negative, 38 positive, 391 total—9.7%.

"This survey brought out several interesting points. It appears that the distribution of new students is quite uniform over the State, but the hookworm infestation was largely confined to residents of a group of about fifteen counties lying in the east-central part of the State. The average infestations for student residents of Mississippi, was about 1 to 10, while for the group of counties mentioned above it was approximately 1 to every 4.

"The Southern Grass Worm, *Laphygma frugiperda*, was under observation during the greater part of the active period of 1920. Very few natural controls were in effective operation against it earlier in the season, but at the close of the season, this pest was found to be attacked at so many angles by predators, parasites, and disease that there seems little likelihood of a serious outbreak in this vicinity this season.

"Among the agencies of natural control, two were found to be doing effective work, not heretofore noted in this connection. There were a so-called "bee-fly," *Anthrax lucifer*, and a type of caterpillar disease known as "polyhedral disease." A statement in regard to these beneficial parasites has been prepared and will be published in the next number of the Journal of Economic Entomology."

In regard to our studies of parasites of the Boll Weevil, Mr. Allen McIntosh makes the following report:

"During the summer and fall of 1920, an effort was made to gain some knowledge of the boll weevil parasites. An experiment was

started on August 20th and continued throughout the month of September.

"Infested squares and bolls were collected and mailed in by inspectors of the State Plant Board. This material was placed in breeding cages where the weevils and their parasites were allowed to emerge. Material for conducting this experiment was received from forty-five counties of the State.

"The purpose of the experiment was to determine the percentage of boll weevil parasites, the number of the different species present, and their distribution over the State.

"From the experiment some localities were found to have as high as 30% of the weevils parasitized. While in other localities there were no parasites found. In many places there were species of parasites found that did not occur in other parts of the State. Many species of parasites were obtained, the majority of which have not yet been determined."

In regard to the studies that have been made of the May Beetles this year, Mr. J. M. Langston makes the following report:

"At the beginning the the year 1921, it was planned to make a survey of *Phyllophaga* (*Lachnosterna*) of this State. Letters were sent out to all the men employed in the field by the State Plant Board, and to a number of club boys and girls, asking that they send in May Beetles. A number of men working in the office of the State Plant Board and Entomology Department and several students have brought in specimens. All of these have either been determined here or sent to a specialist for determination.

"During the month of March we received 1,576 specimens (1,009 males and 567 females), belonging to seventeen different species, collected from trees and at lights from fifteen places in Mississippi, the majority from Agricultural College. Specimens belonging to twelve of these species were taken feeding on pecan trees. In April, 1,870 specimens (845 males and 1,025 females), from sixteen places were examined. These belonged to twenty-three species and specimens of seventeen species were found feeding on pecan. During May 535 specimens (222 males and 213 females) were received from fifteen places. These belonged to twenty species and specimens of eleven species were taken feeding on pecan trees.

"The cool weather during the last of April and first part of May apparently stopped the beetles that were out from feeding and no doubt retarded the development of those not yet emerged, so that few were taken during May. Under normal conditions they would probably have been as numerous during May as they were during April. This may have the effect of bringing out a larger number in June than is usually the case.

"According to the records of past years, we should get eleven more species this year, with a possibility of turning up two other species, of which the record of their occurrence in Mississippi is doubtful. It is

planned to get out a publication on the Lachnosterna of Mississippi as soon as we have sufficient information for this purpose.

"A summary shows that during the three months covered 3,981 specimens (2,076 males and 1,905 females) were taken from twenty-seven different localities. These belong to twenty-five species, specimens belonging to twenty of which were found feeding on pecan trees."

PUBLICATIONS.

During the past two years several press circulars have been issued. Coming from this department the following Station bulletins have been published:

Technical Bulletin No. 9. "North American Ipidae of the Subfamily Microcinae with Descriptions of New Species and Genera."—By M. W. Blackman.

Bulletin No. 191. "The Mosaic Disease of Sugar Cane in Mississippi in 1920."—By L. E. Miles.

Bulletin No. 195. "Experiments in Dusting and Spraying Peaches for the Control of Curculio, Brown Rot, and Scab."—By O. I. Snapp and Leslie Pierce.

Another technical bulletin on Bark-beetles (Ipidae), by Dr. Blackman, is now ready for the printer. Numerous other papers will probably be ready for publication during the next year.

Conclusion.

In conclusion, I wish to express my thanks for the many courtesies extended to this department and to the writer personally.

Very respectfully,
(Signed) R. W. HARNED,
Entomologist.

ANNUAL REPORT OF THE DAIRY DEPARTMENT.

To the Director:

Sir:

We take pleasure in submitting herewith, the annual report of the work of the Station Dairy, for the year ending June 30, 1921.

One of the most important projects in the department has been a continuation of the work in determining the best season of the year for the dairy cow to begin her lactation period. This work has extended over a period of three years, covering 146 lactation periods; sixty-six of the cows, calving in the early fall and eighty, calving in the late fall. The average difference per year per cow was 683 pounds of milk and 27.5 pounds of fat in favor of the late fall calving. This is of great value to the dairyman and should be published during the year.

The results of the three years' work to determine the influence of Spring vs. Fall Calving, show a difference in favor the fall calving. The

cows calving in the fall of the year gave an average of 172 pounds of milk and 18.4 pounds of fat more than did those calving in the spring. If only the late fall calving cows had been included the difference would have been greater.

Calf Raising.

In a preliminary test to determine the effect of putting young calves under six months of age on pasture as compared with keeping them in the barn, the results were decidedly in favor of the lot that was kept in the barn.

Value of Cottonseed Hulls.

Considerable work was done to determine the value of this feed, as compared with Johnson Grass Hay. Further information will be required before definite conclusions can be drawn.

Blackstrap as a Feed.

Experiments were made to determine the value of this feed as compared with corn in the feed of both the dairy cows and calves. The results of these tests indicate that the farmers can easily afford to substitute blackstrap molasses for corn, when the cost per pound is the same for each. Corn is easier to feed than molasses. On the other hand, the molasses will increase the palatability of the roughage fed. At the same price it will no doubt prove profitable to substitute molasses for at least two or three pounds of corn daily.

Cost of Raising Calves.

A careful record has been kept to determine the cost of raising calves. This work has not yet been completed, but some valuable data is being secured.

Miscellaneous Work.

Mr. Brintnall, our Dairy Experimentalist, began his work only one year ago. The work was new, the funds were limited, and the equipment was inadequate. In view of these facts, he was not able to carry out in full the plans outlined, but he has secured some valuable results and has begun other lines of investigation which should give, when completed, important information.

Mr. Brintnall's report shows the necessity of repairs at the dairy barn and the need of laboratory equipment, together with sufficient funds for carrying out some very important lines of investigation which we are unable to begin because of the lack of funds during the past year. Of course, it is very desirable to keep the Dairy Experimentalist, and there is also a need for funds to pay a fellowship student to assist with this work. It is also necessary to have money to cover the expenses of feeds, labor, supplies, stationery, etc.

In addition to the above, there is another matter in which every department at the College handling livestock is most vitally interested. This

is the erection of a suitable stock judging pavilion. We know of no building for which there is more urgent need than this. It is absolutely impossible to give a satisfactory course to the students in judging dairy cattle, beef cattle, horses, mules, sheep, hogs, etc., without such a building. It is generally conceded that the best extension work with the farmers is that which gets them to the College for a one or two days visit. Much of the good that could be accomplished is often lost by the lack of such a building. If this pavilion were available we would have many of the livestock associations, calf clubs, and other organizations of like character holding their regular meetings at the College, thus enabling it to perform a much greater service than it is now doing for the farmers of our State. I am sure that the need of such a building should be placed clearly before the members of the Legislature at its next session.

In conclusion, permit me to thank you most heartily for your cooperation and support in the work of this department during the past year.

Yours very truly,

(Signed)

J. S. MOORE,
Professor in Dairying.

ANNUAL REPORT OF THE DEPARTMENT OF BOTANY

To the Director:

Sir:

I submit herewith, for your informaton and approval, the report of Mr. D. C. Neal, Plant Pathologist to the Experiment Station. This seems to me to be an excellent report of the progress made and gives an outline of further work which needs to be undertaken by this Division. I heartily endorse the report and ask that the recommendations which he makes be carefully considered and endorsed.

The Botany and Forestry Department is offering as full cooperation as is possible under present conditions, to Mr. Neal and to the Station, and expects to make this closer when we get into the new building. During Mr. Neal's absence from the College we handle specimens and inquiries for him. We also identify a very large number of plants sent in from all sections of the State during the course of each year and write the senders relative to them.

We freely offer and hope to continue to be of service to the Experiment Station.

Respectfully submitted,

(Signed)

J. M. BEAL,
Professor of Botany and Forestry.

Mr. J. M. Beal,
Chief in Botany,
Agricultural College, Mississippi.

Dear Sir:

I beg to submit the following report of the Station work now in pro-

gress by the Division of Plant Pathology. The writer was appointed to the position of Plant Pathologist during April of the past year and reported for duty on May 1, 1920. On assuming my duties as Plant Pathologist, it was first necessary to spend considerable time in securing suitable equipment for the laboratory, office and greenhouse. As soon as this was partially accomplished, a preliminary survey of the more important plant diseases existing within the State was undertaken. This was carried out with the view of ascertaining the more important diseases of the various cultivated plants in the State, their economic importance, etc., so that some information could be had as to just what investigational work was needed regarding certain diseases. After spending some time in the field, it was deemed best to begin work on the following projects:

Tomato Diseases.

Investigation of the various disease of tomato occurring in Mississippi is now in progress. During the summer of 1920, visits were made by the writer to the commercial trucking sections of the State to determine in the field the diseases that were present. Visits were made to Hinds, Copiah, Stone, Harrison and Lauderdale Counties. Given in the order of their importance, the following diseases were found: Tomato wilt (*fusarium lycopersici*), blossom-end rot (Physiological), early blight (*Alternaria solani*), southern blight (*Sclerotium rolfsii*), bacterial wilt (*Pseudomonas solanacearum*), and fruit rots, such as black spot (*Phoma destructive*), nailhead rust (*Alternaria solani*), and soft-rot (*Rhizopus* and *Fusarium* spp). Special study is being given to tomato wilt from the standpoint of developing by selection strains of tomatoes which are resistant to the disease. A number of selections were made during August and September of the past year, from varieties which had been previously selected by the Bureau of Plant Industry as being wilt tolerant. Studies have also been made in the greenhouse in reinoculated, sterile soil and in non-sterile, inoculated soil as to the wilt tolerance of a number of varieties. The work is being continued this year on a much larger scale, and all selections made the past year have been propagated again in wilt infected seed beds and the plants planted in progeny rows on wilt infected soil. In this connection special attention is being given to developing an early, wilt-tolerant strain that will satisfy the commercial grower. Crosses are being made between the early commercial varieties and our most favorable wilt resistant selections. It is hoped that the writer will be able to submit for publication a bulletin dealing with certain phases of this work at the close of the present year.

Sweet Potato Diseases.

Experiments are now in progress in regard to the susceptibility and immunity to black-rot (*Sphaeronoma fimbriatum*) of the more important varieties of sweet potatoes. These varieties include Nancy Hall, Porto Rico, Triumph, and Dooley Yam. Seed stock of the four varieties were carefully selected from the standpoint of freedom from disease on April 28, and all showing any sign of disease were discarded. The stock was

then treated with the regular bichloride of mercury standard solution and bedded in the following manner:

Bed A. Divided into equal sections for the four varieties. Contaminated with black-rot (*Spaeronema fimbriatum*) by mixing in the soil one gallon of ground black-rotted tubers.

Bed B. Divided into equal sections as above. Contaminated with black-rot by thoroughly spraying the soil of the beds with a pure culture of the black-rot fungus.

Bed. C. Divided as above, not inoculated.

It is the plan of the writer to determine the amount of the disease on the four varieties when they are ready to be transplanted and also the percentage of infection at harvest. From field observations made during the summer and fall of 1920, it would appear that the Nancy Hall is perhaps slightly more susceptible to black-rot than is the Porto Rico. It is to be hoped that the above experiments will give some definite information along this line.

Pecan Scab Studies.

This work consists largely of spraying experiments for the control of the disease. Scab (*Fusicladium effusum*) of pecan has been causing serious loss to pecan growers in the State. Especially is this true with the large commercial growers along the Mississippi coast. Spraying experiments are now being conducted by the writer at Ocean Springs and Enterprise, Mississippi. A dormant application of 4-5-50 Bordeaux mixture was applied to blocks of trees at Ocean Springs, representing four varieties of pecans. These particular varieties are now scabbing badly in this part of the State. A second application was applied on April 21, 22. It is planned to give at least six applications as a maximum to some of the plats, and to reduce this to a minimum of three or four in others. It is hoped that an efficient and practical spraying schedule for the control of pecan scab can be worked out. The spraying at Ocean Springs is being applied with a Deming Power Sprayer, capable of maintaining a pressure of between 250 and 300 pounds. The trees at Enterprise are being sprayed with a barrel outfit.

Corn Root-Rot.

The work on corn root-rot (*Fusarium moniliforme*) is being conducted under the supervision of the writer by Mr. J. C. McKee, of the Department of Botany. This work has only recently been started, but it is expected, as a result of these investigations, that much information can be obtained as to the seriousness of this disease, percentage loss, and the possibilities of developing strains of corn which are resistant to root-rot attacks. The report of Mr. J. C. McKee is herewith enclosed:

Mr. D. C. Neal,
Agricultural College, Mississippi.

My Dear Sir:

The work with corn root-rot (*Fusarium moniliforme*) was started with

the idea in view to determine, if possible, if we had any varieties of corn resistant to the fungus. With this in view, it was decided to use the sand box method for making the test. Two boxes were used, each accomodating 48 rows, with twenty grains to the row. Box No. 1 was exposed to normal light and the soil was inoculated with fungus. Box No. 2 in which a check set was run was placed under abnormal light conditions(according to Val-leaux).

From the work that has been completed, it is impossible to draw any definite conclusions. The present data, as a matter of fact, only suggest that the light conditions will have a great deal to do with the fungus attacking the young seedlings. There was nothing to indicate any difference in resistance with the 48 strains of corn tested.

It is planned to carry the work on during the summer months and at the same time to check results obtained with same corn under field conditions.

Yours very truly,
(Signed) J. C. McKEE.

New Diseases Occuring in the State and Additional Research Needed.

Several apparently new plant diseases and others which have only recently been found to exist in the State are as follows: Mosaic Disease of sugar cane, *Botrytis* rot of peony, Rice Blast (*Piricularia oryzae*), oat blast (Sterility), a bacterial disease of ferns, corn root-rot (*Fusarium moniliforme*) and surface-rot (*Fusarium oxysporum*) of sweet potatoes. The Mosaic disease of sugar cane is now known to occur in some twenty-odd counties of the southern part of the State, but no research work has been attempted with this disease because of inadequate funds. Additional research appears to be needed on this problem from the standpoint of insect transmission, the overwintering of the disease on certain wild grasses, corn, sorghum, and other annuals. Oat blast (Sterility) has also been reported as causing 30% damage in Rankin County. Other diseases on which early information is desired include cabbage yellows (*Fusarium conglutinas*), cabbage black-rot (*Pseudomonas campestre*), onion mold (*Marcosporium sarcinula*), and peach bacteriosis (*Bacterium pruni*).

Plant Disease Survey Work.

The Plant Disease Survey of the Bureau of Plant Industry at Washington appointed the writer Chief Collaborator for the State on May 1, 1920. Other collaborators include Mr. J. M. Beal, Chief in Botany, Agricultural College, Mississippi, and Dr. L. E. Miles, Plant Pathologist, Mississippi State Plant Board. The purpose of the work of the Survey is to keep as accurate records as possible of the various diseases existing in the State; their prevalence, losses caused from year to year, and the control measures that are being emphasized for their eradication. Any new diseases encountered are also reported, and annual reports during the grow-

ing season are submitted to the Washington office, relative to all plant diseases occurring in the State.

Examination and Identification of Material.

Numerous letters and specimens of plant disease have been received and examined during the past year from various sections of the State, and wherever possible remedial measures have been supplied. Inspection of plant shipments for disease are also being made by this division for the State Plant Board whenever their regular Pathological Inspector is absent in the field.

Respectfully submitted,
(Signed) D. C. NEAL,
Plant Pathologist.

ANNUAL REPORT OF THE DEPARTMENT OF HORTICULTURE.

To the Director:

Sir:

Complying with your request for an annual report of the Experiment Station work in Horticulture, I beg to submit the following:

The last Station Bulletin on Horticultural work was printed during April, 1911. This related to investigations brought down to the summer of 1910. From that time to July 1, 1920—a period of ten years—no Station work of any kind in horticulture was attempted at the A. & M. College Station.

July first, 1920, Mr. J. C. C. Price assumed the duties of Station Horticulturist, giving half of his time to Station work and drawing half of his salary from Station funds. The other half of his time was given to the division of Horticultural Instruction, his salary for this work coming from the College salary fund.

To aid in starting work, the College orchards and vineyard were placed at Mr. Price's disposal. To these, at proper planting season, such new settings of trees, vines, and plants were made as available facilities seemed to justify. The Station furnished one double team of mules. The Station and the Horticultural Department of the College agreed on a plan for cultivating jointly the orchards and garden crops in which the Station is interested, each endeavoring thus to aid the other in giving best attention to the several crops at least cost.

The record shows that during the past season the following settings of trees and vines were made: Apples, 138 trees; Peaches, 259 trees; Pecan, 50 trees; Japanese Persimmons, 22 trees; Figs, 45 trees; Cherry, 12 trees; Grapes (bunch), 120 vines; Grapes (Muscadine), 76 vines. These trees and vines and the land in small fruits and vegetables cover an area approximating twelve acres.

I am glad to report that inspection of work from time to time during

the past year impresses me with the fact that under conditions and restrictions with which Mr. Price has been contending in the conducting of the Station work, he has done remarkably well. So far, trees, vines, etc., are progressing as favorably as could be expected, but I fear that unless something can be added to available funds in sight, best attention cannot be given work in progress until the end of the calendar year. We should like very much to put on other work outlined during the summer and fall months.

Respectfully submitted,
(Signed) A. B. McKAY,
Professor of Horticulture.

ANNUAL REPORT OF THE POULTRY DEPARTMENT.

To the Director.

Sir:

The experiment for 1920, beginning April first, was a comparison of four varieties of hens to determine their economic value as egg producers alone. Two of the leading egg varieties and two of the leading general purpose varieties were used, the White and Brown Leghorns, and the Rhode Island Reds and Barred Rocks.

We found that the Reds ate 72 pounds in the twelve months and the Barred Rocks ate 76 pounds, the Rhode Island Reds laid $112\frac{1}{2}$ eggs per hen, average, while the Barred Rocks averaged 107 eggs each, while the profit above feed cost showed a considerable difference, much more so than the amount of difference in feed and the amount of difference in egg production. The Reds ate only four pounds less in feed and laid only $5\frac{1}{2}$ eggs more per hen, yet the Reds showed a profit above feed cost of \$1.20 each, while the Rocks had a profit of only 29 cents each. This great difference is accounted for largely by the fact that the Rhode Island Reds laid more eggs during the fall and winter months when the egg prices were higher than did the Rocks. In comparing the White and Brown Leghorns, the Whites ate 69 pounds of feed per hen while the Browns ate only 61 pounds of feed per hen. Comparing the egg production of these two, the Whites laid 13 dozen eggs, while the Browns laid $10\frac{1}{2}$ dozen, the Whites showing a profit of \$2.26 per hen and the Browns only \$1.84.

Another comparison that we have under way this year is a comparison of proteins as to their relative value as egg producers. In this test 64 White Leghorn pullets are used, divided into four equal pens and as nearly equally divided as possible, according to their ability to produce eggs. They are being fed the same feeds except for the proteins. One pen is fed on cottonseed meal and 25% of a mash ration. A second pen gets the same feed except that Beef Scrap is used for the protein. A third pen is fed skimmed milk as its protein, and the fourth pen is used as a check pen and gets no protein at all.

We have only three months results to report, but taking the check pen as a basis and assuming that the difference in egg production between the check pen and the other pens is due to the different proteins, they are worth, valuing eggs at twenty-five cents per dozen, as follows: Cotton-

seed Meal, \$240.00 per ton; Beef Scraps, \$250.00 per ton; Milk, \$16.00 per ton.

This experiment has just begun and time may change these figures very materially.

Summary of Results.

In comparing general purpose breeds from the egg producing standpoint alone, Rhode Island Reds prove more profitable than Barred Plymouth Rocks. Comparing White and Brown Leghorns as egg producers, the White Leghorns prove to be the more profitable. Comparing cottonseed meal, beef scraps, and milk as egg producers, all have proven very profitable but the experiment is too much in its infancy to determine which is the most profitable.

All projects are still under way and a new project that we are contemplating starting is comparing laying hens, and pigs on a milk test, that is, to determine whether it is more profitable to feed the surplus farm milk to hens or pigs.

Respectfully submitted,
(Signed) E. P. CLAYTON,
Prof. of Poultry Husbandry.

ANNUAL REPORT OF THE FARM MANAGEMENT DEPARTMENT.

To the Director:

Sir:

I submit herewith a brief report of the work done by this department within the last year.

During the winter of 1919-20, Dr. Clothier and Mr. Andrews of this department collected confidential summaries of the years business on about 500 farms in Mississippi. Of these farms, there were 160 in Jones County, 140 in the truck growing region of Copiah County, 100 in Tate County, 20 in Sunflower County of the Delta, and 45 in portions of the Black Prairie, accessible to the M. & O. Railroad. Of this data only the farms of Jones County have been tabulated and this tabulation will not be completed before the first of July, 1921.

However, the analysis of the years business seems to give the following indications as to the most profitable type of farming in the long leaf pine region:

1st. Those farms which had 16% of the crop land in Cotton made a larger labor income than the farms which had a greater or less amount. The average for the 160 farms was 31.5% of the crop land in Cotton.

2nd. The average of crop land in Corn was 44.5%. The farms which had only 12.2% of the crop land in Corn made the largest labor income and the labor income of the farms was inversely proportional to the amount of crop land in corn.

3rd. The average farm in this area had 8.2% of the crop land in Oats, but it was found the labor income was directly proportional to the amount of crop land in oats. The farm which had the largest labor income had

26.5% of the crop land in oats, and this was the group having the largest amount and indicates that this crop might be increased with profit.

4th. The average of crop land in Lespedeza was 2.97%. The labor income on these farms increased as the Lespedeza acreage was increased up to about 15% on the crop land.

5th. In tabulating the effect of a large number of cattle upon farm profits, it was found that the labor income increased as the per cent. of the productive animal units in cattle increased. The average farm in that County has 72.8% of the animal units in cattle. These are mostly of dairy type. The group of farms which had an average of 92.6% of the productive animal units in cattle made the largest labor income.

6th. It was found that the labor income decreased as the per cent. of productive animal units in Swine was increased.

7th. The total average investment of one of these farmers was \$6,819.00, of which 67.5% was invested in real estate. After paying 5% interest on this investment, the average labor income was about \$450.00.

To tabulate the data on the 160 Jones County farms has required the continuous work of two clerks for four months each, and a similar amount of time will be required for Copiah County and each of the similar size surveys.

To tabulate the data for the projects outlined will require the continuous employment of two clerks for the next two years. We have yet to tabulate the results of the other surveys already taken.

Projects now under way by this Department are:

1st. A continuation of the surveys of Jones and Copiah Counties.

2nd. A survey of 100 or more farms in Bolivar County. (It is the plan of this Department to co-operate with a few farmers in each of the areas surveyed in keeping cost accounts, so as to have more detailed information on labor requirements and the cost of production.)

3rd. The survey of an area in the northern brown loam soil type in cooperation with the Office of Farm Management of the U. S. Department of Agriculture. In this survey they contribute \$1,200.00 per year as salaries in this project. According to our agreement it will continue for a term of years. The data is to be worked up by this office. It is also a part of this cooperative project that complete cost accounts will be kept on a limited number of farms in that proposed area in order to check the survey data.

4th. The Boy's Farm Management Club project gives records of man and horse labor done on the boy's home farm, and also the expenses and receipts of said farm. This project will give some good information on the cost of producing crops and a seasonal distribution of labor on crops and livestock in several sections of Mississippi. So far, about 30 boys in the State are keeping excellent records.

The projects 1, 2, and 3 will give good information on the most productive types of farming on each of the different soil types.

Very respectfully yours,

(Signed) J. N. LIPSCOMB,

Agricultural Economist.

To the Director.

Sir:

ANNUAL REPORT OF THE AGRICULTURAL ENGINEERING DEPARTMENT.

General Remarks: The following data and observations were made as preliminary tests to observe the practicability and limitation of tractor work under Southern conditions. No special preparation or selection of proper fields was made, either in its relation to shape of fields, drainage, or topography.

The first field selected was prepared for corn. All operations including plowing, disking, harrowing, planting, and cultivation, were done by power farming implements. No mules or horse drawn implements were used except in the final cultivation after the corn was in tassel.

The plowing was done with a 10-20 Titan tractor, pulling an Oliver No. 78, which is a No. 12 two-bottom plow with a single section harrow attached. Planting was done with an ordinary two-row planter, pulled by a Bailor motor cultivator. All cultivations were with this cultivator except the last, which it was necessary to do with a horse drawn cultivator.

Some difficulty was experienced in that there was excessive rainfall during the year and this field is not very well drained. Another trouble was that the field was irregular in shape and not suitable for power farming. The test shows the great need of proper drainage and properly shaping the fields in order that tractor and motor cultivation may be used successfully.

The following is the cost of preparation and cultivation of an acre of land:

Cost of Plowing Per Acre.

4 gallons kerosene at .25	\$1.00
1 quart gasoline at .30 ..	.08
1 quart lubricating oil at \$1.00 per gallon .....	.25
1 day labor at \$2.00 per day .....	.50
Total	\$1.83

Cost of Disking.

1 gallon kerosene at .25 ..	\$.25
1 pint gasoline at .30 per gallon .....	.04
Labor at \$2.00 per day .....	.25
Oil at \$1.00 per gallon .....	.25
Total	\$.79

Cost of Cultivation.

1 gallon gasoline at .30 per gallon	\$.30
Lubricating oil (practically none with the exception of loss in changing oil every three days) ..	.10
Labor at \$2.00 .....	.23
Total	\$.63

The motor cultivator, which was a one-row cultivator, averaged nine acres per day during the extreme hot weather, when mules could only have worked about half time.

A test was also made of saving hay with motorized outfits. This consisted of all operations being made with power machines. The results of this test show conclusively that seventy-five per cent. of labor can be eliminated in haying operations by the use of tractors and motors, and the time reduced at least 50%. This is the most important advantage in order to keep the loss of hay down to a minimum during unsettled weather conditions, using a minimum of labor and consuming a very short period of time between the cutting and putting the hay into the barn.

The results indicate that by using the side delivery rakes less time is consumed in loading hay and better color and higher quality is obtained.

(Signed)

F. C. COTTRELL.

ANNUAL REPORT OF THE BRANCH STATIONS.

South Mississippi Branch Station.

To the Director.

Sir:

We have the honor to submit the annual report of the South Mississippi Experiment Station for the year 1920-21.

On account of a change of location with this Station from McNeill to Poplarville, and in order to make this name more suggestive to the territory in which it serves, we have changed the name of the Station from McNeill Branch Station to South Mississippi Experiment Station, while the work being carried on at McNeill is under the name of Coastal Plains Experiment Station.

While the Station at Poplarville has no official connection with the one at McNeill, the two institutions have worked in perfect harmony and have been very helpful to each other in the exchange of labor, machinery, and plans of work. On account of the connection of the Station at McNeill with the Department at Washington, we are visited here by many of the experts from the Washington office, who have rendered many valuable suggestions and have furnished seeds for many promising crops. Last fall an assortment of vetches and bur clovers were given us for testing here and among them we have found several that give promise of greatly improving our winter pastures. In our new location our connection with the local Agricultural High School is very close and altogether pleasant and profitable. The students from this school do a lot of the work on the Station farm and keep constantly in touch with all experiments in progress here by frequent visits with their instructors, who explain to them the nature of the work and find it a great help in teaching agriculture and horticulture.

During the period covered by this report a great many improvements have been made on the property at Poplarville. These include the completion of a twenty-cow dairy barn; addition to and slight changes in the mule barn; a complete rearrangement of fields and the building of several

miles of inside fences, so as to divide the land into a number of fields separately fenced, all of which have been set aside for specific experimental work; a little more than \$4,000.00 was spent on a cottage for the local director, and as this is located within the corporate limits of the town of Poplarville, adjoining the Agricultural High School, and at the intersection of two important highways, a good deal of effort has been put forth to make the place attractive by beautifying the grounds and providing attractive shrubs and flowers; a neat office has been built close to the above cottage, which gives space for several desks and a special room for filing the numerous bulletins which are received here, the old paupers home has been divided into two parts and these moved so as to front on the highway and converted into two five-room cottages for labor; the cottage formerly used as a home for the poor house keeper has been added to and such changes made as were required to meet the demands as a home for the Station foreman; a sweet potato drying house was built last fall and complete records kept during the winter with the curing of this important crop; one new cottage for labor has been built; all buildings, new and old, have been painted, yards and gardens provided, and shade and fruit trees set out. These buildings complete the present needs of the Station with the exception of a home for the Station Horticulturist, who now lives in a rented cottage in Poplarville, and whose work demands that he live closer by, but our finances will not permit the building of more houses at this time.

During the past year practically all results of work done at Poplarville and all that done in recent years at McNeill and not already printed in bulletin form, has been published in several bulletins and reports; these include Bulletin No. 188, "A Report of Work at McNeill Branch Experiment Station from 1912 to 1917, Inclusive;" Bulletin No. 194, "A Report of Work at South Mississippi Experiment Station from 1918 to 1920, Inclusive;" Bulletin No. 196, "Cotton Growing in South Mississippi"; and Bulletin No. 199, "Sugar Cane for Syrup Making," the last being a reprint of an old bulletin issued years ago, the edition of which has been exhausted and which we revised and brought up to date. There are several other bulletins written at McNeill, which have been exhausted and for which there is still considerable demand, and we are at work now preparing new ones on the old subjects, which we hope to revise and reissue in the near future.

In the early history of this Station at McNeill, a great deal of work was done with fruits and vegetables, the kind and varieties best suited to the section, how best to fertilize them, together with the growing of a number of these crops in quantities sufficient to determine their value from a monetary standpoint. After several years of work of this kind and after our sales fund was taken from us, we were forced to abandon much of this kind of work on account of a lack of funds and the seeming greater importance of other lines of work at that time. This country, however, seems destined to become at some time one of the main trucking sections of the country, having soils naturally suited to such crops and being served by one of the best railroad systems of the entire country, with access to all the important cities of the North. The people recently have manifested much

more interest in truck than they formerly did, so with increased support from the last Legislature, we decided to renew work of this character and last year engaged the services of Mr. F. B. Richardson, a graduate of one of our leading universities, a man of wide horticultural experience and at that time employed as Extension Horticulturist for the State of Mississippi. Mr. Richardson has started some very important horticultural investigations, which we report in his own language:

"1. Variety tests of fruits and vegetables and foreign plant introductions.

"A. Fruits—Variety tests of peaches, plums, grapes (including grafted *vinifera* grapes), figs, dewberries, strawberries, blackberries, raspberries, blueberries, pears, Japanese persimmons, pecans, English walnuts, and citrus fruits.

"B. Vegetables — Sweet potatoes, cantaloupes, watermelons, tomatoes, beans, cauliflower, and cabbage.

"C. Foreign plant introduction — *Salvia hispanica*, *parthenium*, *ciner eaefolium*, *selanum tuberosum*, *solanum bullatum*, and *allium capa*.

"2. Plant Selections:

"On Irish potatoes, sweet potatoes, sweet corn, tomatoes, said selections being carried on with a view of increasing productivity marketable qualities and disease resistance. The work on tomatoes is concerned especially with selecting wilt resistant strains; four varieties that are apparently wilt resistant are now being tested in soil inoculated with wilt fungus.

"3. Fertilizer Investigations:

"This work is being done with tomatoes, potatoes, and strawberries. Sod and clean culture plats are being used in figs, peaches, pecans, and satsuma oranges.

"4. Cultural Practices:

"Records are being maintained on pruning work, spraying for control of insects and diseases, cultivation and use of cover crops on orchard and truck plats."

Thirteen acres of land selected as being the best here for the purpose, have been set aside for this work, with fruits and vegetables and practically all the work as outlined above has been started. Apparently the work done years ago with truck crops at McNeill is having its effect now in the interest being manifested by individual farmers in truck crops. As a result of the work started by the Station at McNeill, the people of this small village have gradually increased their acreage until now they ship beans, cabbage, squash, Irish and sweet potatoes in car lots and are, perhaps, the largest shippers of such products in South Mississippi, off the Illinois Central Railroad. This interest has recently extended to peaches and some one hundred acres of peach trees were set out at McNeill last winter, through the efforts of the fruit and vegetable agent of the Southern Railway, and the people there are now organizing to plant a similar acreage to strawberries. This interest has extended to other nearby points

on the Southern Railway, large plantings of peach trees have been made at Poplarville and Hattiesburg, and trucking having been started at Poplarville and Purvis.

In order to be effective, fertilizer work has to extend over a series of years and be conducted on land of known history. In order to obtain reliable results from a large number of experiments with fertilizers, planned by ourselves with the assistance of one of the leading fertilizer experts of the country, we have permanently set aside here about ten acres of our levellest land which has been divided into some one hundred small plats. These have been fertilized the same way for the past two years and will continue to be so fertilized for a number of years to come, with the hope of being able finally to get positive and definite information as to the needs of these soils for the different elements of plant food, with and without the application of lime, the use of restorative crops and the practice of rotations.

Work is being conducted both at McNeill and at Poplarville, with the development of permanent pastures. Here we have set aside twenty-six acres of land to this work. This has been divided into two equal parts, on one of which we are growing oats and lespedeza, and the other carpet grass planted in several different ways. Seeds are being saved from the most promising kinds of winter legumes, notably the bur clovers, and these will be sown over both pastures with the hope of furnishing better grazing in winter and early spring. These pastures are being used for cattle and hogs and last year the pasture from oats and lespedeza proved wonderfully efficient, the seasons having been unusually favorable. It remain to be seen what the same crops will do when the summer is dry and the lespedeza liable to be killed out from lack of moisture.

Adjoining the above permanent pastures, is a ten-acre field devoted to the growing of field crops for hogs. Here we hope to get valuable data as to the cost of pork production, using lespedeza and oats for permanent pasture and testing out such crops as peanuts, soy beans, chufas, and cow-peas as additional summer feed crops. We have now four brood sows, a number of shoats, and some thirty pigs with which to carry on this work.

At McNeill we kept a number of dairy cows, milking an average of twenty or more animals. The most of these were grade Jerseys. On moving to Poplarville, there was not room for so many cattle and all save the registered Jerseys were sold. These registered animals were brought to Poplarville, there being ten cows and several each of heifers and calves. Shortly after moving them here we were milking ten cows and expected to start experimental work with them, but hemorrhagic septicemia appeared suddenly in the herd and four of the best cows died in a day. This did not leave a sufficient number with which to do experimental work, so the herd has been held together awaiting the time when a sufficient number of heifers would grow into cows. The milk from this herd has more than paid the expense attached to keeping them and we have had the calves at a profit. A little more than a year ago a very fine Jersey bull was leased from a party in Georgia, for use as a herd bull. This animal has 75% of the blood of the noted Jersey bull for which the Sharples Separator

Company paid \$60,000 and already we have several heifer calves from him with other cows about ready to freshen.

In collaboration with Dr. Brown, of the Main Station, and the three other Branch Stations of the State, this Station is carrying on work improving strains of cotton and corn and the testing of a number of varieties of these two crops. Last summer Dr. Brown spent several days here making field selections of corn and cotton and the seed from such selections have been planted here this year for further work in this direction.

We hope, in the future to do more publicity work than in the past. Although for a number of years annual excursions were run to McNeill, to bring in people interested in visiting the Station, and one summer some four thousand people came on these excursions. Later they were discontinued as the novelty of such excursions wore away and the people stopped coming in sufficient numbers to make the train pay. Last summer we held a special day here and invited the county agents to bring in automobile parties. Quite a number of these came and a very profitable day was spent, but on account of rainy weather and bad roads, the attendance was not so good as we had hoped for. We are planning to continue these excursions here and will use every means to popularize the work of the Station with the farmers of the territory it is supposed to serve.

With its present support fund this Station has been able to materially improve the effectiveness of its work and to engage the services of a scientific expert in the person in Mr. Richardson.

Respectfully submitted,

(Signed) E. B. FERRIS,

Assistant Director.

HOLLY SPRINGS BRANCH STATION.

To the Director.

Sir:

Herewith, I submit my annual report for the work done at the Holly Springs Branch Experiment Station for the year 1920-21.

Since my last report, conditions have changed very materially. Labor was very unsettled in 1920 and we had to pay twice as much per day as under normal times. At present we are paying \$1.50 per day for regular hands and for seventy-five cents to \$1.25 for extra help. At present, labor is plentiful and more anxious to work.

The Legislature was much more liberal with the Station than at any period in the past. Several much needed tools have been added; a 15-30 H. P. Illinois Tractor with plows and disk harrow for same. Also a Motor Cultivator, Culti-Packer, Silage Cutter, Milking Machine, Two Row Corn and Bean Planter, and a few small tools. A one hundred ton Concrete Silo and a 2,500 bushel Potato House has been built. The Milk House has been moved near the barn and properly equipped with separator, aerator, wash sink and boiler. The separator was exchanged with the De Laval people

for a new one, at a cost of freight both ways. Sixteen feet was added to the Dairy Barn and a 2 H. P. motor with electric line to connect with the City Power Plant, to run the milker, was also added.

All of the buildings on the grounds will be painted this summer.

The season of 1920 was very wet up until September, after which it was very dry. Much fall-sown grain was lost on account of the drouth. This spring the weather was extremely wet and now it is dry. We have only a fair stand of cotton and corn. All replanting will not come up until after a rain. There is not a fifty per cent. stand of cotton or corn in this section.

Both the Home Economic and County Agents of North Mississippi have held meetings at the Station and we think to the advantage of all parties concerned. Tate, Tallahatchie, and Union Counties have brought large parties of farmers and high school students to visit this Station. These separate parties from Tate County visited the Station during the past month. The Dairy, Terraces, Potato House, and Vetch, or winter legumes, were of special interest. August 19, 1920, was Marshall County Day at the Station. Some 350 people were present. We expect to have the farmers visit us this summer.

Rather late in the Spring of 1920, some simple experiments with fertilizers under cotton were started at the following county sites and agricultural high schools: Lafayette, Tippah, Tate, Panola, Tallahatchie, Holmes, and Desota Counties. The seasons were unfavorable and poor results were obtained. We think a simple experiment of this kind in each county properly supervised and results published in regular bulletin form with our results would be the means of the Station knowing more of the requirements of each county and should make the bulletins more attractive to the public. Part of this work should be done by the Assistant Directors. If such work is placed with the Agricultural High Schools, special attention will have to be given same, as has been our experience. They have not the time and the work will be neglected.

Several meetings have been held in each of the following counties: Marshall, Lafayette, Union, Tippah, Alcorn, Tishomingo, Prentiss, Lee, Tate and Tallahatchie. Since the decline in the price of cotton, the Station has been very popular.

Soil Erosion is still the curse of the country. Broad shallow terraces should be used to protect every acre of land in North Mississippi, and as to that matter, every acre in the State. Valley land properly terraced prevents excessive wet lands in most instances. Winter cover crops, wheat, rye, vetch, crimson and bur clovers, will assist materially in preventing soil washings.

Fertilizers: Both nitrogen and phosphorous, either alone or in combination, give very satisfactory results on both hill and valley lands. Some of the experiment plots that have been running for fourteen years were discontinued and a more complete system introduced. Seventy-three plots, using all of the carriers of both nitrogen and phosphorous that are now

available for fertilizers, have been introduced. On valley land where no fertilizer has ever been used, a mixture of 200 pounds acid phosphate and 100 pounds nitrate of soda, or its equivalent in nitrogen in cottonseed meal, tankage and other forms, gave an increase of as much as 600 pounds seed cotton per acre in some instances. Our results on hill land for the past fourteen years are similar. Fertilizers under corn are not so marked. There is no question but that corn needs the fertilizer, but the water supply is the limiting factor. With proper seasons the use of fertilizer pays well, with improper seasons the use of fertilizer under corn does not pay. However, I wish to state that we use a liberal supply under all plantings grown for feeding purposes. The past year, twelve acres planted to corn produced enough feed for our entire work stock for the year, also including colts fed during the winter. We have found that corn grown in five and one-half foot rows, using as many stalks per acre as in narrow rows, and either soy or velvet beans planted between the rows, does not decrease the yield of corn and gives the beans as an extra crop. We think that every acre of corn in Mississippi should grow beans or peas every year. Our motto is: "Two crops and a legume on every acre of land each year." The strawberry land is the only soil that escapes the growing of two crops per year. We are conducting a very extensive experiment on the broad row for corn with beans between the rows. The usual variety and fertilizer experiments with corn are being conducted.

Cotton: Some seed selections made by Dr. Brown and Mr. Ayres, of the Delta Station, have been planted in duplicate on both hill and valley land in addition to the regular variety and space test. The highest yield of cotton in 1920 was 2,850 pounds of seed cotton per acre. The average was over a bale per acre. There was no boll weevil damage the past year, but many weevils entered this section in late fall.

Legumes: Vetch, lespedeza, velvet and soy beans, cowpeas, and all the clovers do well. Black Medic is doing nicely this year and our hopes are all very high with this plant. Plantings made last spring on limed land are extra good and fall plantings are seeding nicely. Red Clover, planted in September, is now thirty inches tall on hill land. A small quantity of lime was used. We can express the needs of North Mississippi in very few words: Terraces, lime, summer and winter legumes, the use of a small quantity of fertilizer, livestock—preferably the dairy cow, and a few men interested in agriculture. I am convinced more than ever that the future welfare of this country depends upon the business man of other professions coming to the front and assisting the farmer in marketing his products at a fair profit and at the same time preserving his soil. The presidents of the five banks in Marshall County and a half dozen supply men can put over any scheme that they want in this county, and in almost any county in the State a similar condition exists. With the success of all business depending upon the agricultural success. I think the business man is the man to work on in place of giving all of our time to the farmer.

Sweet Potatoes: Believing this crop should have our special attention, we constructed a 2,500 bushel potato house and in the future expect

to make the sweet potato one of our special crops. The house is complete in every way and is attracting special attention. Potato diseases, Black Rot and Wilt, are scattered all over the county. Some loss was sustained with us this past year. For this reason special attention is being given to eradicate these diseases. The State Plant Board has Messrs. McGeehee and Lott stationed here with an office at the Experiment Station, inspecting all shipments of plants that enter the State. We consider this work almost indispensable. We have 35 bushels of potatoes bedded for slips and have taken every precaution to prevent diseases. We have made the potato diseases a subject in all talks over the State.

Dairy: We have an up-to-date plant. It is our purpose to add a few Register of Merit cows at an early date. Our milking machine saves thirty dollars per month. We are prepared to feed silage at any time, beginning in mid-summer or extending into late spring. Much attention has been given pastures. As a whole, we consider the dairy, the sweet potato, and cotton the hope of North Mississippi.

The Model Home grounds with orchard, garden, and poultry yard, is in progress and the house will receive our special attention this fall, if funds can be spared to do the work.

In conclusion, I wish to state that Mr. Harris F. Wallace, Assistant, and Mr. J. C. Ryan, Foreman, have been of material assistance in bringing about whatever success this Station has made the past year.

Respectfully submitted,
(Signed) C. T. AMES,
Assistant Director.

DELTA BRANCH STATION.

To the Director.

Sir:

I submit herewith, a brief report of the Delta Branch Station for the annual period, ending June 30, 1921.

The work of the Station for the past year has been conducted along the same general lines as in previous years, but somewhat broadened in many respects. On the whole, the results were fairly satisfactory, especially when certain adverse conditions are considered. The lack of available funds at the times when most needed, together with high priced, insufficient labor made it necessary to leave undone many things that would have added greatly to the value of the work under way. The cropping season of 1920, was about the most unsatisfactory on record, and as a result, several lines of our work were greatly hampered. The rainy weather during the fall damaged much of the seed of our valuable new strains of cotton before it could be gathered, causing a very poor stand in the cotton breeding work of 1920. Good weather prevailed, however, during the fall of 1920, and almost perfect stands have been gotten for the 1921 crop.

Public Meetings.

For a number of reasons, no public meetings of any consequence were held at the Station for the past few years. There were, however, many large parties of planters visiting the Station Farm during this period and much interest was shown by the visitors in all activities of the Station. Plans are now being made to hold a two or three days meeting on the Station Farm during August or early September of 1921, which promises to be one of great interest. The management encourages visits from the planters of this region, as there are many valuable lessons for them at all seasons of the year that can be gotten from a visit that can never be gotten from a printed report.

Publications.

During this period, due to the high price of printing and a shortage of funds, this Station has not published as many bulletins and reports as the management wished for, but several bulletins have been issued, containing much valuable information. Data is now about in shape for two more interesting bulletins, which will go to press in a few weeks.

During the past winter, several hundred large posters were printed and distributed. These posters contained some very condensed and interesting data on corn and cotton, arranged in a very attractive manner, which created a great deal of interest throughout the entire country. One of these posters contained a condensed report on several years work in cotton spacing and has created a great deal of attention. Many of the planters have called for a poster for each of their tenants. This poster has proven so successful that a great number will be sent out in the future.

Improvements.

The Legislature of 1920, passed an Act authorizing the management to retain \$20,000.00 from the Station's sales fund, to be used in making permanent improvements.

To date, a little less than \$15,000.00 has been realized, but it is hoped that before the end of the year, the full \$20,000.00 can be obtained. Above \$13,000.00 of the amount collected has been spent in making some very much needed improvements. The grounds have been so laid out as to give more room, and to permit of beautifying, while the old buildings have been rearranged and made into very attractive and comfortable quarters for the Station employees. The sewer, lighting and water system have been enlarged and a modern new residence for the Director, that is in keeping with the best plantation homes, is nearing completion. With the remaining \$5,000.00, if realized, it is planned to use this in building three hollow tile cabins for labor, repair some of the old cabins, and in building of some much needed fencing and concrete walks.

Corn.

The work with corn during this annual period, consisted of the usual variety studies, dates of planting, cultural methods, fertilizing, and breed-

ing work. This work, in spite of the very bad season, has developed nicely. Of the many varieties tested over a series of years, Cocke's Prolific and Mosby seem to be the varieties best suited to Delta conditions, and the ones the Delta planters should tie to. At the time of adding a Plant Breeder to the Station staff, on March 1, 1920, a program of corn breeding work was inaugurated, and even at this early date, splendid progress has been made towards isolating some promising strains of both Mosby and Cocke's Prolific. Some very extensive work in fertilizing and spacing corn is also being carried on.

Cotton.

Cotton continues to receive the greater part of the Delta Station workers' attention, and in spite of an unusual number and variety of adverse conditions, some valuable work has been done. As a result of bad stand, much of the cotton breeding work of 1920 was of no value. It is worth while mentioning two new cottons the Plant Breeding Department has developed, one an Express x Sunflower cross, the other a Foster selection, No. 6102. The Express x Sunflower cross, is a $1\frac{3}{4}$ inch cotton, with the earliness and fruiting habits of Express, and promises to be a most valuable addition to the cotton of that length. The Foster selection No. 6102, is a 1 3-16 inch cotton, with many very desirable qualities. It made a most enviable record last season. With a very bad cotton season and crop failure all about it, this cotton yielded 807 pounds of lint per acre on six and a half acres without fertilizer. This strain will make an excellent cotton for the most fertile lands of the Delta region.

Cotton spacing work during the past two years has been stressed, and the results of this work certainly deserved mention. A report of this work has just been published and has attracted much attention over the entire cotton world. The tests made along this line prove conclusively that in general practice, the cotton planter leaves not more than half enough cotton plants per acre, and as a result, loses many millions of dollars each year.

The extensive cotton fertilizer work being done has now been running long enough to point towards some interesting conclusions. They are, that Delta soil of the Deer Creek silt loam type respond only to nitrogenous fertilizers, and that the best and cheapest forms of that are gotten through the growing of legumes. Proof of the fact that this type of soil, which makes up a large portion of the best drained Delta soils, is depleted very slowly in the mineral fertilizing elements, will save the Delta planters millions of dollars in the course of a few years, if this knowledge is taken advantage of.

Small Grains.

During the passing period small grains have received but little attention. Variety tests of wheat were discontinued, but work with oats on a small scale was continued.

Beginning with the present cropping year, the Plant Breeding Depart-

ment has inaugurated considerable work with oats, and it is hoped that some varieties and strains will in time be developed that will be better adapted to Delta conditions than those in existence today.

Live Stock.

No particular experiments have been conducted with live stock during this period.

Some hogs and sheep, however, are kept for demonstration purposes. Both have proven of interest and profit.

Forage and Legumes Crops.

Several tests with alfalfa were completed and put in shape for reporting during the past period, and some new tests were started, but on account of very unfavorable seasons the crops were lost, and the work discontinued for the time being.

Work with clovers and vetches is being carried on. An effort is being made to isolate some new anthrax nonresisting strains of bur clover. This disease threatens to destroy the growing of bur clover in the Delta unless some resistant strains are developed.

Variety tests of cowpeas and soy beans are being made during the present cropping season with the hope of finding varieties better adapted to Delta conditions.

Drainage.

Drainage will always be a big factor in connection with Delta Farming and the work in drainage started at this Station several years ago will be continued for a number of years yet. Results to the present time indicate very clearly that tile lines under impressions and sloughs should have many surface inlets to aid in taking off as rapidly as possible the surface water that collects in such places, which would destroy any crop if left to get into the tile by percolation.

Horticultural Work.

As in previous years no great amount of experimental work in horticulture has been undertaken. However, some very excellent demonstrations in home orcharding were done. The Delta Station orchard produced peaches and plums last year that were as fine as any ever grown anywhere. By diligently pruning, spraying and worming the orchard, the Delta planter can have as nice fruit as is produced anywhere in the country.

A few varieties of grapes are also grown in the little home orchard, with most excellent success. The quantity and quality were all one could desire. Every Delta planter should have his fences covered with grape vines.

Variety and culture tests with most all garden crops are being made, but this work has only recently been started and although some interesting

data has been collected, nothing conclusive along this line is ready to report.

Respectfully submitted,

(Signed)

G. B. WALKER,

Assistant Director in Charge.

RAYMOND BRANCH EXPERIMENT STATION.

To the Director.

Sir:

The Raymond Branch Agricultural Experiment Station was established by an act of the State Legislature of 1920. Funds for the establishment and support of same were appropriated as follows: For the purchase of land, six thousand dollars; for buildings and improvements, six thousand dollars; for general support during the biennial period 1920 and 1921, five thousand dollars per year.

Soon after the passage of the bill the Board of Trustees, assisted by a committee of local citizens of Raymond, began looking for a suitable location. They purchased fifty acres of land, known as the Williams' tract. This place is one mile east of Raymond, and sixteen miles south-west of Jackson, and fronts along the gravel road connecting them. It adjoins the farm of the Hinds County Agricultural High School, and also the property of the Hinds County Prison Farm. It was purchased for the sum of seven thousand and five hundred dollars, six thousand dollars for the land and fifteen hundred dollars for a three room cottage. In consideration of the Board purchasing this land, the Hinds County School Board deeded to the Station thirty-nine acres off the High School tract adjoining it, and the Board of Supervisors deeded to it eighty acres off the County Farm property. This makes a total of one hundred and sixty-nine acres owned by the Station, all in one block and very desirably located.

Full possession of the land was not obtained until January 1, 1921, but the Assistant Director took charge as soon as the titles, deeds, etc., could be examined and recorded, and on September 24th began work. With the permission of the owner, building and improvement was started immediately. It was necessary that a Station residence be built and that the cottage be moved to a more suitable location. Because of the extremely high price of both lumber and labor at that time, it was apparent that the available funds would allow only a very small residence, so it was decided to start a nice residence and bring it as near completion as the funds would allow. Accordingly, a modern six room bungalow was begun and enough of it finished to serve as a residence and office. About four thousand dollars was used for this purpose and the other five hundred remaining of the building fund was used to move the cottage, rebuild foundation, chimneys, and flues, and make some minor repairs.

The support fund for the year 1920, was used in building a model barn to accomodate the work and provide ample room for hay storage, salaries,

feed, office equipment, to purchase four mules, harness, a wagon and a minimum amount of farm tools.

The support for 1921, has been and is being used for general support, that is, salaries, labor, office expense, fertilizers, seed and sundry supplies. In addition to this, this fund has been forced to cover: some fencing, feed for four mules, trees for a small orchard, a few farm tools that we could not possibly do without and various other items.

Before experimental work could be done we were forced to combat a problem of drainage. Upon the best land there were several levees retarding the natural drainage, these have been cleaned up and partially worked down. There was also a winding ditch grown to willows and located in the wrong place. A new canal has been started that will drain several acres that have been too wet to cultivate and small surface ditches have been made that will take care of any ordinary rainfall.

The outside fences are in a bad condition and we have patched them up enough to keep out cattle. A small amount of new fence has been built around the barn and orchard.

Much time has been spent this year in getting the plots laid off and put in condition to begin permanent experiments, it being necessary to study the uniformity of the soil in each plot and have both chemical and physical analyses made. Experimental work under way at present consists of: studies of various forms, amounts and combinations of nitrogen, phosphorus and potash carrier when used under cotton, corn and tomatoes; studies of various crop rotations and their practical application to this type of soil; comparisons of different forms and amounts of lime; tests to determine the relative effect of soy beans, varieties of soy beans and velvet beans on the yield of corn; tests of nine and eleven varieties of cow-peas for both grain and hay; tests of four varieties of sorghum and three of millet to determine their relative productivity and their adaptability to this section; a study of grasses and clovers to determine the combinations best suited to this locality; studies of twenty varieties of early and fifteen varieties of late corn; and twenty-four varieties of long and short staple cottons; a small orchard, consisting of eighty-four apple and peach trees, on which control measures of insects and diseases will be tried, and a study of varieties made; with sweet potatoes comparison of varieties, also of the yield of late versus the early planted slips, and slips versus vines. Other than the strictly test plots, enough corn is being cultivated to supply feed for the work stock.

The Station has made good progress with the money in hand, but has been somewhat handicapped in getting the necessary improvements made on account of the inadequate appropriation. To carry on the work efficiently, an increased appropriation will be needed. For instance, the whole farm must be fenced, some money spent for drainage, the residence must be completed, and one or two minor buildings erected. The management

hopes that sufficient appropriation can be obtained to put this Station on its feet, so to speak, in order that it might serve the farmers of this section in the way that it is supposed to do.

Respectfully submitted,

(Signed)

C. B. ANDERS,

Assistant Director in Charge.

